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Secrecy in Technical Work

Those who have been reading the technical journals of the leading industrial countries during the past winter must have been impressed by the unusual publicity given to methods of production and the detailed design of apparatus still in course of development. It would seem as though the old policy of secrecy in such matters had largely disappeared. Not only have works formerly forbidden even to large customers been thrown open to the inspection of properly credited visitors, but technical processes still incompletely developed have been described in papers before scientific societies. The spirit of the scientific investigator has possessed the engineering world during the last six months, and progress has been correspondingly rapid.

It has been generally recognized for some years that the day of secrecy in business was past, but the publicity of late has nevertheless been surprising. Those who are engaged in the work of developing a process or a machine are aware that sooner or later most of the facts concerning it leak out. A recent union of tanneries showed that the jealously guarded secrets of each plant were well known to all the others. Lack of publicity had forced the managers of each plant to work out the problems for themselves at considerable expense. The same thing is probably true in most industries. The discovery of natural laws that one man makes another can also make, and the machine that one man invents can be designed by another. The protection of the Patent Office is better than that of guarded doors, and the cöoperation of a loyal staff of good men is better than the old-fashioned organization patterned after the seclusion of a prison.

It is interesting to observe that the companies which are introducing new machinery and products most extensively and successfully are generally those that are the most ready to make public all the facts connected with manufacture. They rely on excellence of design and character of workmanship to assist in the sales of their products, and they welcome publicity concerning such features. If information is withheld by them concerning some machine or some process it is because the company itself is not assured that the information can be given with certainty as to its correctness, and it does not care to stand sponsor for incorrect or misleading announcements. The strongest companies to-day are not those which have the most secrets, but those which have the best men. It is not the ability to discover and then hide some new process which spells success so much as the ability to discover and utilize it to the full, attracting attention to its advantages and safeguarding its possession by the legal methods authorized in all civilized countries for the purpose. The ability to take the most complete advantage of an invention or a discovery is a matter of human nature, and men, not secrets, form the best asset of any company.

Panama Canal Projects.

The engineering investigations already completed by the Isthmian Canal Commission and the large amount of work performed in preparation for the prosecution of actual construction have stimulated the setting forth of a number of projects for the design and construction of the Panama Canal. The suggestions of interested engineers and contractors have also been somewhat quickened by the recent recommendation of the Engineering Committee of the former Isthmian Canal Commission for the construction of a sea level canal. Furthermore, the anticipation of rapid development of construction work along the canal line and the creation of the Board of Consulting Engineers to consider and report upon the plans ultimately to be adopted have aroused ambitious projectors on both sides of the Atlantic, whose propositions, in some cases at least, are characterized by marked originality and force. It does not follow that such originality and force are always directed toward the most judicious ends, but the resulting projects will generally justify the serious consideration of the Commission and its Board of Consulting Engineers, and they are also the subjects of interesting comments in the formation of a well-balanced popular judgment.

Without question the most interesting among such gratuitous projects are those now advocated by Mr. Lindon W. Bates and Mr. Bunau-Varilla, the former a dredging contractor of international experience, and the latter a former engineer and contractor of unusual ability on the Panama Canal itself. While Mr. Bates has spent but a few weeks on the Isthmus his extensive experience in dry and under-water excavation gives interest to any views which he may entertain in regard to the interoceanic waterway. Mr. Bunau-Varilla, on the other hand, has spent four years or more continuously at Panama engaged in the active work of construction as prosecuted by the old Panama Canal Company. It is an interesting fact, and indeed one of deep significance that these two authorities advocate projects whose main features are diametrically opposed.

Mr. Bates' project is a lock canal, brought as nearly down to a sea level waterway as practicable without reaching that type of canal, i. e., "fixed on levels anywhere from + 25 to + 7," but preferably with a summit level 20 ft. above mean tide. Mr. Bunau-Varilla's project is also that of a lock canal, but with the summit level at about 130 ft. above mean tide, or as high as can reasonably be contemplated. The former would place a lock and dam at Mindi, near the Caribbean end, and another lock and dam at La Boca near the Pacific end of the canal; while the latter would use probably eight or nine locks in connection with his 130-ft. summit level.

Mr. Bunau-Varilla's project, however, involves far more than the initial construction of a 130-ft. summit level lock canal, as he would so design the locks as to permit the reduction of his waterway to a sea level canal by excavation commenced immediately after its opening and conducted throughout a period of possibly twenty or twenty-five years. He maintains that the necessary excavation could be made without serious inconvenience to navigation and without essential increase in cost, but it is supposed that these latter views have not been generally shared by members of the first Commission.

Mr. Bates has set forth the main features of his project in a highly interesting book, dealing not only with the physical aspects of the proposed work, but also the financial elements of the problem. He takes issue with the engineering committee of the first Commission in regard to their recommendation for a sea level waterway, mainly on the ground of too small a prism, and upon the additional cost required by the sea level plan, although he would also modify radically the proposed method of control of the Chagres floods. A full synopsis of Mr. Bates' brochure was given in the issue of The Engineering Record of a week ago, and by referring to it his plan of control may readily be appreciated. Also by referring to that statement of the plan, it will be seen that he entertains an alternative, which involves two additional locks, one at Bohio, and one at Pedro Miguel, raising the summit level to 52½ ft.

The elaboration of plans or projects for this great engineering work is full of both fascination and danger. It is exceedingly interesting to treat the general elements of this problem involving the topography of the Isthmus and the control of the Chagres River so as to develop them into plausible paper projects of great apparent merit, but precisely therein lie the gravest dangers for fertile engineering imaginations. If ever an engineering project required abundant, serious and deliberate consideration of actual quantitative data, together with the fullest details of a physical character, the Panama Canal project requires it in the highest degree. All features of every plan proposed must be subjected to the criterion of exact computation based upon data secured on the grounds and interpreted under the actual conditions of the Isthmus, as determined by experience there.

Mr. Bates proposes to build a dam at Mindi, near Colon, and another north of La Boca, at the Pacific end of the canal, where there is no firm support in either case for such a structure except at depths beyond the reach even of the pneumatic process. He anticipates this difficulty to some extent, and suggests that if available sites are not offered at those points the dams may be moved to sites that are available. While The Engineering Record is not prepared to express its final judgment upon any plan, it may be stated that such a treatment of the main feature of this particular project, on which the very existence of the canal would depend, leaves much to be desired.

Again, the amount of excavation required for a 20-ft. summit level, not stated by Mr. Bates, is so large a percentage of that required for sea level, that it may be a serious question indeed whether having excavated that far it would not be judicious to excavate 20 ft. deeper, and do away with dams and locks founded upon a material of uncertain resisting capacity.

Again, the area of cross-section of the prism advocated by the Engineering Committee of the first Panama Commission is held by Mr. Bates to be insufficient. As a matter of fact, a careful reading of the Engineering Committee's report discloses no recommended area of cross-section whatever. That committee recommended 35 ft. as a minimum depth and 150 ft. as a minimum bottom width, and it is well known that at least two or three members of the Commission, and possibly of the committee itself, favored 40 ft. as a proper depth if a sea-level waterway should be adopted. The area of cross-section, 7,150 sq. ft., cited by him, is about that of the former Isthmian Canal Commission, assumed for its purpose of comparison between the Nicaragua and Panama routes. Indeed, the minimum depth and bottom width assumed by Mr. Bates are in accord with those of the Engineering Committee, as a careful reading of its report will show.

The method of regulating the control of the Chagres advocated by Mr. Bates and consisting of two or more dams built across the Chagres at Gamboa, Alhajuela, and possibly at other points, is a matter which must be tested by computation of flood volume and flood flows of that river and the currents induced in the canal prism. It will also be necessary to demonstrate by actual computations of reservoir capacities, in view of the flood volumes to be regulated, whether it is more judicious to build one large reservoir sufficient for the purpose or to construct a number of smaller ones, as well as to compare the relative costs of two such different projects. It is certain that the proposition to discharge even the "controlled" Chagres floods into a canal prism of only 8,000 sq. ft. in section, even though the flood volume be divided to flow in two directions, is a measure of doubtful wisdom. In short, it may be presumed that the main duties of the Board of Consulting Engineers will consist in testing all these projects, founded largely upon generalities rather than upon demonstrated data, and subject them to crucial quantitative comparisons. Plausible presentations without the definition of exact computations are much more easily followed by popular readers than exact technical treatments, and popular impressions thus formed are all the more likely to be erroneous. The fact that projects so radically different in character as those of Messrs. Bates and Bunau-Varilla, actually at the opposite extremes of feasibility as lock canals, one having twenty feet summit elevation and the other one hundred and thirty, can be presented in such a taking way as to secure at sight the endorsement of two great dailies of the New York press, is conclusive evidence of the necessity of cool and searching analysis in the ultimate determination as to the best type of ship canal to be constructed across the Isthmus of Panama.

An Unsolved Problem in Electrical Engineering.

The James Forrest lecture before the Institution of Civil Engineers this year was delivered by Col. R. E. B. Crompton, and was a discussion of some of the unsolved problems of electrical engineering. In it he considered lightning discharge, the sources of terrestrial magnetism, the electric transmission of power, the improvement of the magnetic field of dynamos and motors, insulation, and a number of other subjects upon which few engineers care to be absolutely positive except when engaged in the preparation of trade literature. But these opportunities for improvement he relegates to the background in the closing portion of the lecture, where he outlines the great work of electrical engineering, as follows:

"Finally, I believe the greatest problem of all, and the one which will have the most profound influence on the well-being of our fellows, is the satisfactory development of our power schemes by which we hope to send the population back to the land. Power-distribution schemes of various degrees of magnitude have already been started in many countries. In those where water-power was available they have made considerabl progress; but in this country, where we have to look to the generation of our power from fuel, the series of problems involved are of the highest interest, are extremely hopeful of speedy solution, and the social consequences that will follow on them are likely to be so important to the health and better development of our race that they deserve the most careful consideration of our best men. We already see that the necessity for bringing our working population into huge factories, so that they may work within the range of power allowed by revolving shafting, is already at an end; that nearly all power can be supplied through electric motors, and therefore the factory units themselves can be small, spaced more widely apart, and many classes of manufacturing processes can be carried out most perfectly in the worker's own home aided by the other members of his family."

It is not often that an eminent engineer thus publicly deserts his chosen profession to wander into the field of social economy, and when he does it is of interest to follow out his line of thought. The greatest problem of electrical engineering, if solved according to Colonel Crompton's suggestion, would convert many of the great industrial plants of the country into ruined piles of masonry and junk. If this decay were accompanied by the improvement of the condition of the working men and the trades people dependent upon them for business success, without a lowering of the quality of the products or a rise in their price, we would all agree with him. Those who have seen the condition of the home workers in Switzerland, France and Germany will hardly be impressed by the force of the argument, however, any more than those who have seen American homes in which the men engage in their callings. In the abstract it is, of course, pleasant to think of the workman tending his looms under his own roof-tree, and his occasional trips to the window to see how the flowers are growing in his modest garden bring a touch of nature to the artificiality of his toil. But it is just these little distractions which interfere with his work, make it less productive and often of poorer quality than that done in the shops. No man can do his best work when he is called away every hour or so to mind the baby or otherwise employ himself in household tasks. In short, it is difficult to imagine any general industrial condition that would be improved by the home-labor part of Colonel Crompton's suggestion. The removal of industries from crowded cities to country places, where there is plenty of light and air and room for the homes of the men is an excellent step, provided the men will agree to the change of location, which they generally object to very decidedly. But the factory building must be moved also, in making this change, and any project for the carrying on of skilled labor in the homes of the people is an idle dream, except in a very few industries. Such a project, it is to be hoped, will long remain an unsolved problem.

The Abuse of Mill Construction.

Fire insurance underwriters have done well to take up the abuse of mill construction that has become prevalent. Slow-burning construction for mill buildings, developed under the lead of Mr. Edward Atkinson a number of years ago, has been applied in an unintelligent manner to classes of structures for which it was never intended, and in a perverted way that detracts from a large part of its merit. This type of building was designed for textile mills primarily, having their stories unobstructed by partitions and provided with outside towers containing the stairs by which the several stories were reached, so that no openings in the floors were needed. These buildings were not filled with merchandise of a combustible nature, but were employed for light manufacturing purposes. The class of construction suited for them is not necessarily the best for warehouses in crowded cities, where the contents are combustible and the stories must be reached by inside stairways. One of the objects of the design in its original form was to avoid all those hidden flues and passages for the spread of fire that are formed by the flimsy partitions and sidings that seem the inevitable accompaniment of even the cheapest mercantile building in a large city. Mill construction is not in every respect the best type to adopt for storehouses unless it is very carefully designed, and the serious fires that have occurred in warehouses and stores of so-called mill construction are no true indication of its value.

The basic idea governing the design of the first slow-burning buildings of this type was to concentrate all the timber in large members and thick floors having considerable strength long after they were attacked by flames. While strength was carefully considered in preparing the designs resistance to fire received the first consideration. At the time the type was evolved, large timber was plentiful and heavy flooring was not very expensive; at the present time it is not at all improbable that reinforced concrete structures can be constructed of equal strength and within five to ten per cent. of the cost of the mill construction buildings in some localities, owing to the high price charged for timber and the present low price of cement. Probably the type of mill construction that would be selected to-day as best by the engineers of the fire underwriters would be very different from the type which is now firmly planted in their judgment as the best owing to the long successful experience with it. In other words, the type was selected for a special use at a period when materials for construction had different relative values and some of them were employed in less economical ways than at present. The great good done by the introduction of mill construction cannot be under-estimated, however, and the fact that the strong and durable buildings erected for special purposes in accordance with its originator's suggestions have proved models for all sorts of improper adaptations of the type for other purposes shows what a dearth of originality possessed the designers of warehouses and factories not so many years ago.

Mill construction remains just as good architecture to-day as ever; its only defect is its increased cost due to the rise in the price of timber. No mill architect can afford to neglect a thorough study of its possible modifications. But in making changes in the original plans which were prepared by Mr. Atkinson and his associates it will be well to bear in mind that gentleman's list of constructions to which the term must not be applied. This list is as follows:

Mill construction does not consist in disposing a given quantity of materials so that the whole interior of a building becomes a series of wooden cells, being pervaded with concealed spaces, either directly connected each with the other or by cracks through which fire may freely pass where it cannot be reached by water.

It does not consist in an open-timber construction of floors and roof resembling mill construction, but of light and insufficient size in timbers and thin planks, without fire-stops or fire-guards from floor to floor.

It does not consist in connecting floor with floor by combustible wooden stairways encased in wood less than 2 in. thick.

It does not consist in putting in very numerous divisions or partitions of light wood.

It does not consist in sheathing brick walls with wood, especially when the wood is set off from the wall by furring, even if there are stops behind the furring.

It does not consist in permitting the use of varnish upon woodwork over which a fire will pass rapidly.

It does not consist in leaving windows exposed to adjacent buildings unguarded by fire shutters or wire glass.

It is dangerous to paint, varnish, fill or encase heavy timbers and thick plank as they are customarily delivered, lest what is called dry-rot should be caused for lack of ventilation or opportunity to season.

It does not consist in leaving even the best-constructed building in which dangerous occupations are followed without automatic sprinklers, and without a complete and adequate equipment of pumps, pipes and hydrants.

It does not consist in using any more wood in finishing the building after the floors and roof are laid than is absolutely necessary, there being now many safe methods available at low cost for finishing walls and constructing partitions with slow-burning or incombustible material.

Regauging Mortar.

In the careful investigations now in progress in many quarters into the properties of cement and concrete, many of the old myths of the mason are being severely criticised. This statement is in a certain degree misleading, because there are master masons throughout the country who have been intentionally violating many of the textbook rules for the use of cement, because they understood better than the authors of the books the practical limitations of safe practice in the manipulation of this material. For example, it was taught in schools and urged in books for many years that mortar should not be regauged. Specifications generally forbade the practice, although all this time a little experiment would show that regauging was entirely harmless under some conditions. Instead of ascertaining by test the truth of the subject, or accepting the offer of contractors to prove that regauging properly done caused no harm, one engineer after another blindly copied the old specifications. Of course there were protests against this decision, and once in a while some engineer would permit the practice that most of his associates considered pernicious, but up to the present time it may be safely stated that regauging is looked upon as a contractor's trick, to be prevented at all times.

In order to ascertain the actual effect of the practice some instructive experiments were made at Sault Ste. Marie under the direction of Mr. L. C. Sabin, U. S. Assistant Engineer, who describes them in his "Cement and Concrete," an indispensable manual for the user of such materials. These experiments were intended to bring out the effect of regauging on the adhesive as well as cohesive properties of mortar, and are particularly important because of the customary omission to examine the adhesive properties. In the first place, these experiments showed that the cohesive strength of a mortar was materially increased by thorough gauging. Doubling the time of mixing was found to increase the strength of the mortar about 5 per cent., and quadrupling the time added 26 per cent. This is important in the light of the subsequent experiments, for it shows that a mortar may be susceptible of considerable improvement if it is rushed through a mixer.

As a large number of experiments are given in detail in the treatise referred to, it is only necessary to point out here that they show no change or decrease in the strength of regauged neat Portland cement mortars, but as these are not used in actual work, the results with sand mortars are more useful. It was found that rich mortars, containing one part of sand, were not seriously affected by standing three hours, if regauged frequently. Poorer mortars, with two to four parts of sand, showed a gradual increase in strength as the result of such severe treatment as standing five hours, if retempered with more water once every hour. These tests were made with cements setting slowly. With cements setting more quickly the results would probably not be so favorable, but such cements were not available for experiment at the time. Tests were made with natural cement, and these also showed poorer results with neat than sand mortars; they did not show such good results when retempered as the Portland cement mortars, but were only seriously injured by regauging when the conditions were such that no engineer would think of allowing the old mortar to be used.

The above data relate to the cohesive strength of mortar. Tests of the adhesive strength were made with mortars used fresh and those allowed to stand three hours, with regauging every hour. Not many of these experiments were made, but they indicated a very important fact. The regauging to which the mortars were subjected usually resulted in a slight increase in cohesive strength, but the adhesive strength was considerably impaired, more with natural than Portland cements and more with rich than poor mortars.

Such experimental investigations as these indicate that there is really no reason in many cases for refusing to permit regauging mortar to a limited extent. Of course no engineer would be justified in allowing this retempering to be done in any way and to any extent that suited the contractor's interests. This would be an invitation to disaster. But it happens in some classes of concrete work that permission to regauge the mortar would be a considerable convenience, and where such cases are likely to arise frequently, the engineer ought to test the quality of regauged mortar so as to ascertain if the practice is permissible with the brand of cement and the grade of sand he is using.

Notes and Comments.

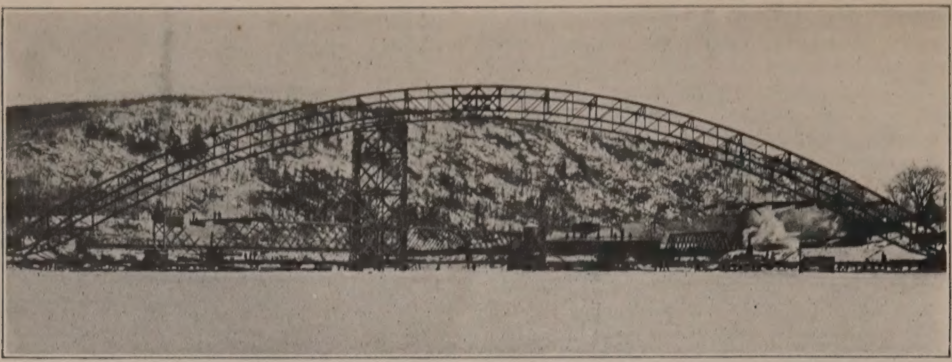
The Poughkeepsie Bridge is to be strengthened in accordance with plans prepared by Mr. Mace Moulton so as to carry the heavy freight traffic the New York, New Haven & Hartford R. R. is prepared to send over it. Although strong enough for the light locomotives and trains of its time, it is unable to carry safely the heavy weights of today, and must consequently be reconstructed. The structure has never had the commercial value it was expected to attain, and while it has always been regarded structurally as an important engineering achievement, the men who manage the finances of railroad undertakings have rated it as a nicely gilded brick. The western expansion of the New Haven system has at last given it the importance that the Reading managers once hoped it would attain.

The Reported Trouble with the masonry arch bridge on the low-grade freight line of the Pennsylvania R. R. over the Susquehanna River at Shock's Mills has been much magnified by the newspapers. During the heavy floods early in the spring, ice was gorged against the bridge nearly to its top. This caused a strong eddy around the lower part of the piers, and there is a possibility that the concrete foundations used under a few of them have been injured. Coffer-dams are now being constructed around these piers to determine the character and cause of the damage. Traffic has not been interrupted over the bridge.

The Municipal Water Power Development that the Mayor of New York has in mind as a part of his project for obtaining an additional water supply from the Catskills is meeting with unexpected opposition at Albany. While there is a disposition to allow the city to utilize the water as a supplement to the Croton supply, the proposal to utilize it for power purposes is strongly opposed. If there is any considerable amount of power available, failure to take advantage of it would be a reckless waste. Attention may well be called to the work done in Seattle under the direction of Mr. R. H. Thomson, city engineer. A new water supply was first developed and then the water power of the same stream was utilized by an electric plant which has only recently been put in operation.

Fireproof Wood is required in buildings over 150 ft. high by the New York building regulations. Many of the leading architects and contractors of the city have petitioned for a repeal of this requirement on the ground that it is of no value. It is claimed that the amount of wood trim in any building of this height is too insignificant to be an element of danger in comparison with the combustible furniture in the offices. The fireproofing is done by a very few companies, who are stated to cause serious delays by the slowness with which they make deliveries. The most important argument is that the fireproofing treatment is only temporary in its results and the wood gradually regains its normal character, particularly where it is occasionally wet, as on floors.

The Responsibility of Sub-Contractors for damages due to the failure of all parts of a building contract to be executed at the proper times was settled by the Michigan Supreme Court last mouth in Cresswell v. Robertson, 102 N. E. Rep. 963. Cresswell was a sub-contractor to Robertson on the Wayne County building at Detroit. His sub-contract required him to cover, protect and secure his work from injury, that any damage to it should be repaired at his expense, and that the inspection of the work by the architects, or their certificates concerning it, or payments under the sub-contract should not release the sub-contractor from any obligation to perform the work in a good manner, and any defect in it should be made good at his expense. The court interprets this sub-contract to mean that where water-leader pipes were placed in the wall within 4 in. of the outer face of the wall, as required by the plans and specifications, and were accepted after being tested, but were subsequently damaged by frost, because of the failure of other sub-contractors to supply steam with which to warm them as contemplated, the sub-contractor was not required to place new pipes in another location ordered by the architects unless paid for the work as an extra.



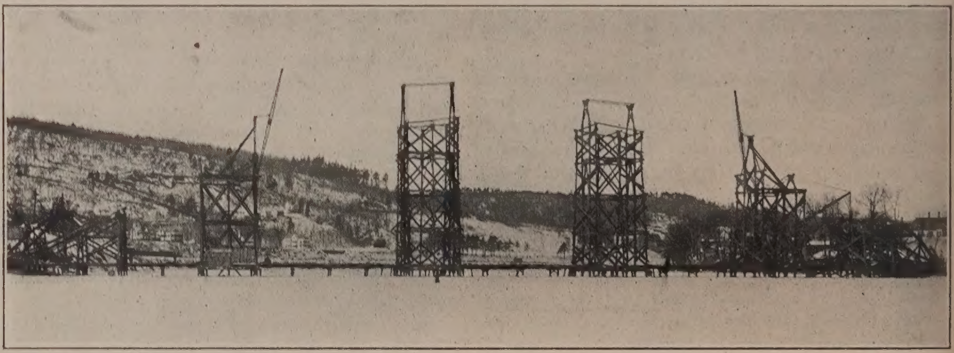
ERECTION OF THE BELLOWS FALLS ARCH BRIDGE.

The main span of the highway bridge across the Connecticut River between North Walpole, N. H., and Bellows Falls, Vt., has two three-hinge arch trusses 540 ft. long and 27 ft. 9½ in. apart on centers, from which the roadway platform is suspended at a varying distance of 16 to 35 ft. above the skewback level. The arch trusses have parallel rectangular chords 14 ft. apart with pin bearings at the skewback hinges and a flat bearing at the crown as illustrated in The Engineering Record of Nov. 5, 1904. The 13½-ft. panels of the chords form chords of a parabolic curve of 90-ft. rise and the maximum height of the top chord is about 106 ft. above low water. The skewback pins are about 9 ft. above low water and 8 ft. below high water. The bridge is of interest on account of its span, which is exceeded by very few arches and is greater than any other highway arch span in this country except that at Niagara Falls, and because the type of suspended floor is unique among long span arch bridges in the United States. It was adopted in competition with other types of bridges and special efforts were made by its designers to secure a rigid structure of pleasing appearance and minimum weight which could be erected at a moderate cost.

The river at this point has a channel in hard compact sand and gravel with rather steep banks below water level. The maximum depth at low water is about 24 ft., and although the current is slight on account of the crib dam about 1,000 ft. down stream, falsework would be endangered by logs or ice going out in large quantities and might be injured by any high flood. The difficulties of erection were increased by the height of the structure, its curved outline and the fact that the permanent steel work was not adapted to be self-sustaining during the erection or to afford facilities for the support and movement of derricks and travelers or the delivery of materials. Cantilever erection was impracticable; erection with cableway would involve elaborate temporary supports for the incompleted trusses; ordinary falsework would be high and costly and afford serious obstruction to the river, and the use of a traveler on it would involve either a very high one to travel at skewback level, a troublesome provision for moving it on the curved top chords or the construction of an upper falseword built up from end to end at the level of the crown of the arch. It was finally decided to erect the trusses first and separately on falsework towers or intermediate temporary piers, spanning the spaces between towers by cantilevering the trusses and assembling the steel work with long booms advanced from tower to tower as the work progressed. This method afforded a sufficient waterway at all times, saved more than half the timber required for complete trestle falsework, and enabled the comparatively light members to be easily and economically handled by a small force of erectors.

The two-post trestles of a service track parallel with the bridge axis and about 6 ft. above low water were first built with piles driven last fall with a pile driver on a scow and were lined up and capped at the same time. The work of erecting the towers was begun about the time the water commenced to freeze up and the ice was used to a small extent as a platform for assembling some of the work during the erection.

Three four-pile bents were driven at panel points at each end of the span and upper stories of framed falsework erected on them to receive the lower chords. Four intermediate, unequally spaced falsework towers were built between the end sections of falsework, each high enough to reach nearly to the lower chords of the trusses and having a length of two panels or 27 ft. and a width equal to that of the bridge. The towers had eight vertical 10x10-in. posts one at each corner and one in the middle of each side, and were built in stories about 18 ft. high braced on all faces with horizontal struts and intersecting diagonals of 3x12-in. planks, bolted on.



End Bents, Intermediate Falsework Towers and Service Bridge.

Three piles were driven to a penetration of about 10 ft. under each of the corner posts, and two under each intermediate post, and A-frames were erected on the tops of the towers in the vertical planes of their outside transverse bents. Materials were delivered on the Vermont side of the river, and were distributed by standard gauge cars pushed by hand on the service track. Stiff-leg derricks with 50-ft. booms were set up on the abutments and with gin poles set on the shore falsework, assembled the ends of the trusses from the skewback pins to the open spaces on the shore sides of the first falsework towers. A 60-ft. steel boom with a capacity of 15 tons was seated in the axis of the bridge on the shore side of the first tower and its topping lift tackle connected to the top of the A-frame there. With it and the falsework derrick the three panels of trusses between the shore falsework and the first tower were built as cantilevers counterbalanced by the weight of the sections already built on the falsework which acted as anchor arms.

The trusses were assembled across the top of the first tower, and were then cantilevered across the five-panel space between the first and second towers, the members being handled by a 60-ft. steel boom seated on the shore side of the second tower and by the steel boom already mentioned which had been moved to the opposite side of the first tower. One panel of the trusses was cantilevered out complete from the tower, and then the four remaining panels of lower chord were lifted in two-panel lengths for each truss by the two derrick booms which supported them until the center joint was fully bolted, when they were held by one boom and the other, being released, assembled the rest of the members to complete the trusses. Erection was carried on simultaneously from both ends of the span, and after the trusses were completed across the tops of the center towers they were cantilevered across the five-panel space between them to meet at the crown in the same manner as just described. By this method all the work was done by four booms successively advanced from tower to tower where they were raised and lowered by each other and by tackles suspended from the A-frames.

Erection was commenced Dec. 6, 1904, and the arch trusses were swung by driving out camber wedges, Jan. 10, 1905, the interval including many days on which work was discontinued on account of severe weather. Under favorable conditions the most rapid erection accomplished was the assembling of the five cantilever panels of two trusses from one tower to the next in two days. The weight of the trusses and their bracing is about 900,000 lb., and the heaviest single members were the 15,000-lb. end sections. No field rivets were driven until the trusses were swung, immediately after which gangs were started from both ends of the span and drove all field rivets by hand from light suspended platforms. Meantime the falsework towers were removed as quickly as possible, and the suspended floorbeams were connected to the trusses from both ends of the bridge towards the center, and the stringers, floor laterals and deck built successively. All the steelwork was handled by two hoisting engines on the service bridge and one on the west abutment, all being of the two-drum, four-spool, Lidgerwood type.

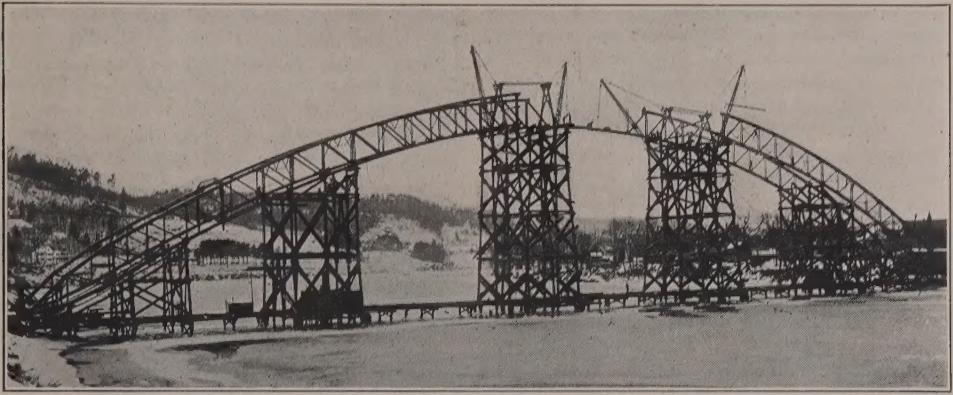
The bridge was designed by Mr. J. R. Worcester, consulting engineer, Boston, and was constructed under the supervision of Mr. J. P. Snow, bridge engineer of the Boston & Maine R. R. It was built and erected by Lewis F. Shoemaker & Co., owners of the Schuylkill Bridge Works, Philadelphia. Mr. L. D. Rights, New Haven, contracting engineer.

The Expansion of Concrete in Sidewalks has caused some difficulty in Mankato, Minn., and joints of asphalt prepared by the American Asphaltum & Rubber Co. for brick paving filler have been placed in the walks to prevent them from being thrown out of line and also to prevent the breaking of curbs at street corners. The joints are 1 to 4 in. in width and City Engineer J. R. Thompson expects they will relieve the difficulties which have been experienced.

Cement in Central Station Design.

A paper presented at a meeting of the Chicago Branch of the American Institute of Electrical Engineers by Eugene B. Clark.

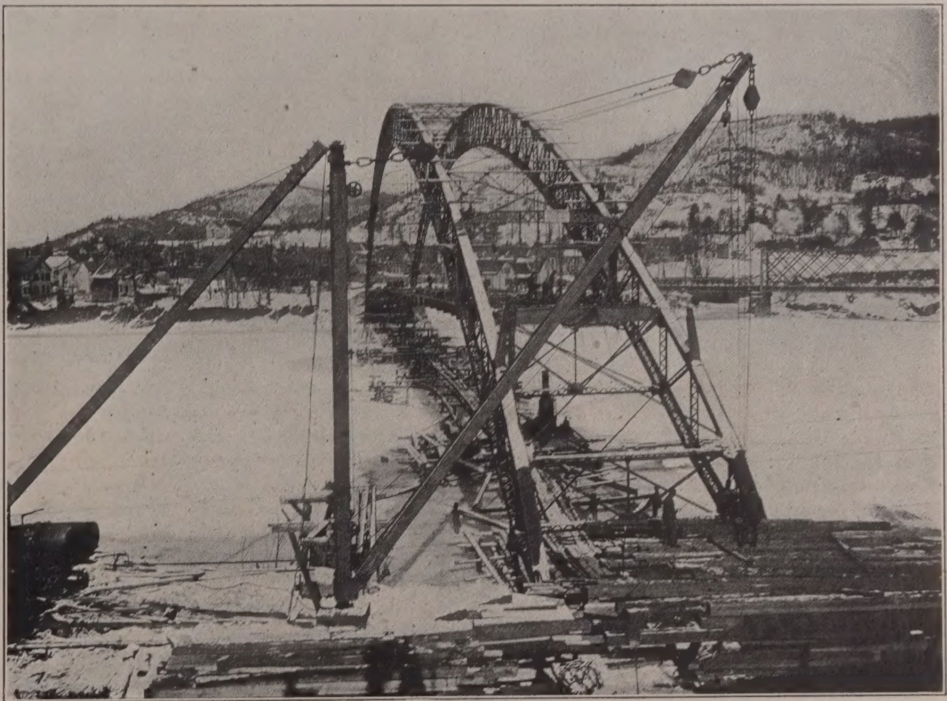
The Illinois Steel Co. has just completed and placed in operation at its plant in South Chicago a new power house for the supply of power to its various mills at South Chicago, and at Buffington, 10 miles distant. This station contains, at the present time, two units, each consisting of a 2,000-kw., 25-cycle, 2,200-volt, three-phase generator, direct driven by a 24x60x48-in. horizontal-vertical, cross-compound engine. The addition of two more generating units, of a capacity of 4,000-kw. each, is contemplated in the near future. This alternating-current station operates in conjunction with a direct-current station which has been in operation for some time. The two power houses are connected by means of synchronous converters. Both stations take steam from blast-furnace boiler houses, in which the fuel is excess blast-furnace gas. The supply of this excess gas is quite variable at times, and it is desirable under such conditions to be able to shift load from one station to the other, as desired. Such an arrangement gives the opportunity of utilizing completely all excess blast-furnace gas at either point.



Closing Last Bottom Chord Panels at Crown of Arch Trusses of Bellows Falls Bridge

The foundations for the machinery and the building rest upon piles and are made of slag concrete, consisting of one part cement, three parts torpedo sand and seven parts crushed slag. The cement used for those parts of the foundations which are not exposed was of the brand known as "Puzzolan"; for those parts which are exposed, "Universal" Portland cement was used. The foundations were started in the coldest weather of last winter, and the concrete, which had to be mixed with warm water and warm sand to keep from freezing in the mixer, did freeze immediately after being tamped into place. Filling was used to follow up the foundations as rapidly as they were put in place, so that the concrete was not permitted alternately to freeze and thaw as the warmer weather came on. The result was to obtain a thoroughly solid foundation, the concrete setting up firmly as it gradually thawed during the spring months. About the middle of summer the foundation was tested by drilling a hole several feet deep into that part which had originally been frozen. It was found that it had set up to make an extremely solid and strong concrete.

A considerable amount of time and attention were devoted to determining the most desirable method of floor construction. The power house apparatus is controlled by electrically operated switching devices. The electrically operated switches, together with the bus-bars, control-pedestals, instrument-posts and feeder-panels, required for their accommodation the construction of galleries at one end of the engine room. Two of these galleries were built, and the engine room floor was used as another gallery. On the engine room floor were located the generator switches; on the first gallery were located the bus-bars, the instrument-posts, generator-control pedestals, feeder-panels, etc.; on the third gallery were located the feeder-switches and the lightning-arresters. A transmission line, carrying a pressure of 20,000 volts, was necessary to transmit the required amount of power to Buffington, located 10 miles south of South Chicago. At least 4,500 kw. of transformers had to be located in the power house. It was decided best to place these on the engine room floor, under the first gallery, constructing an isolated transformer room for that purpose. The transformer room was isolated from the rest of the apparatus on the engine room floor by means of a wall about 3 in. thick and 17 ft. high, built of reinforced concrete, in accordance with the method to be described later. This wall proved, after erection, to be thoroughly solid and substantial; as rigid, in fact, as would have been a masonry wall 12-in. or 14-in. thick. It then became necessary to take wires carrying a pressure of 20,000 volts through the operator's position on the first gallery. In order to harmonize these various requirements, it soon became evident that much additional space would be required if it should prove necessary to have the usual steel beams in the gallery floors, inasmuch as the beams would be in the way of the many wires which it would be necessary to take through these floors. These conditions pointed to the advisability of using a floor construction of concrete slabs or of fireproof tile. Careful consideration of the subject proved that, even with the comparatively long spans for such heavy loads, the concrete construction would be far preferable, both from the standpoint of cost and from the standpoint of fireproofing.



Service Bridge and Nearly Completed Permanent Span, Bellows Falls Bridge.

To make certain of the safety and conservatism of the proposed design, a section of the floor, as proposed, was built and tested prior to the final decision as to the construction of the floor for the building and galleries. After being allowed to set 21 days, this section of floor was tested by piling pig iron upon it, to the extent of 500 lb. per square foot. The test slab was 7-in. thick and 15-ft. span, made of concrete, consisting of one part Universal cement, two parts torpedo sand, and four parts 0.5 to 1 in. crushed limestone, reinforced with 0.5-in. steel rods, spaced 5 in. apart and laid on top of No. 10 gauge expanded metal placed 1 in. from the bottom of the slab. Upon test, the slab collapsed under a load of 550 lb. per square foot. An even distribution of the load over the surface was obtained by covering the top of the slab with about 4 in. of sand, upon which was piled the pig iron. Deflections were measured as the load increased. The deflection at the center had risen to about 1.5 in. by the time the slab failed. It was determined that the expanded metal was comparatively valueless for purposes of reinforcement when used in conjunction with the 0.5 in. round rods, as all the tension was taken by the rods. These rods were bent at the ends for a distance of about 10 or 12-in. through an angle of 180 deg., thereby insuring that they would not pull out at these points. It was found necessary to bend the rod through 180 deg., and not through 90 deg.; for those which were bent only 90 deg. showed a very decided tendency to crack the concrete at the corners and then to pull out. Round rods were used in preference to twisted or notched, or any other form of rods designed to prevent slipping or pulling out of the concrete, and for two reasons: First, the round rods are far cheaper; secondly, it was decided that nothing was gained by preventing the rods from pulling out of the concrete, provided they were properly fastened at each end. The mixture used in all the floor construction was one part Universal Portland cement, two parts torpedo sand and four parts crushed limestone, 0.5- to 1-in. mesh. The shoring under all floors was permitted to remain 28 days before removal. In the engine room floor, for the very long spans, some floor beams were used, but in all cases they were entirely covered with concrete, to give thorough fireproofing.

Wherever generator-pits or fly-wheel pits were to be covered, such covers were made of cement castings, reinforced with expanded metal, rather than of cast iron. These cover plates were made to exact fit for each place as the work progressed, no drawings being necessary. The carpenter made a small mould of the correct size, in which the cement worker cast his floor plate and finished it exactly as the rest of the floor. The gallery floors were completed and the shoring removed before any work was done on the installation of the electrical control apparatus or the supports therefor. Each gallery was treated as independent of the one under it, so far as support was concerned, though, in building up the switch-cells, the bus-bar construction and the barriers, the practical result was to give additional support to each floor from the one under it. The switch structure was also constructed in such a way as practically to be a beam in itself. Round iron rods were cast into the lower part of the structure and allowed to extend through from the first switch in the row to the last. The result was to provide a construction of the switch-cells which, being in itself a beam, would distribute the load to those points where it might best be taken. In addition to this fact, the barrier which rose from the switch-cell to the ceiling above, taken in conjunction with the lateral barriers—all of which were built monolithically with the wall rising from the switch structure—formed a column of great strength. It would probably not be poor engineering to depend, in a measure, upon the strength of this column to support the floor above it; but in the case which is being described this was not done. Even though no attempt was made to utilize the switch structure as a column, still, the fact was taken into consideration that there would be a natural tendency, by reason of the presence of the switch structure, to transmit load from one floor to the one under it, and therefore to impose a greater load upon the lower floor than would be accounted for by the weight actually upon that floor. This effect was compensated for by giving the lowest floor additional supporting columns, which were placed between the basement and the engine room floor. These columns were covered with expanded metal and a cement plaster to insure against failure, in case a fire should occur, due to the storing of inflammable materials. It had not been contemplated that such materials should be stored in the basement, but it was thought wise to provide against this contingency.

The roof of the engine house was constructed of concrete laid in place as is usual for sidewalks. In each bay a removable wooden frame was secured to the structural roof chords in such a way as to permit of ready removal by knocking out wedges after the roof was in place. A thin layer of cement mortar, consisting of cement and sand, was placed on the top of this woodwork support. The function of this thin layer was to give a smooth coat for the finished interior of the roof. The expanded metal reinforcement was laid immediately on top of this preliminary coat, and was covered with about 2 in. of concrete of about the same mixture as was used for the floors. On top of this was placed a thin layer of rich mixture, which was given a sidewalk finish on the side exposed to the weather. After 28 days, the wooden supports were removed from the inside by knocking out wedges, and were lowered to the engine room floor. The roof made in this way developed cracks after drying out. These cracks were filled by pouring into them a thin grout consisting of cement and sand. The result was to stop all leaks and insure a roof which was cheap and thoroughly fireproof. It has the disadvantage of being heavy and requires rather heavier roof-trusses than does a tile or slate roof; it is very strong and is not damaged by men walking upon it, or by falling pieces of stone or other materials. The latter consideration is an important one in the case described, because the station is located near blast furnaces, which, unfortunately, have the habit of throwing stone and ore out of the top at times.

The electrically operated oil-switches which are usually mounted in a brickwork cell structure, were mounted in a cell structure built up of concrete. A collapsible wooden mould was made, set up in the proper position for the switch, and filled with concrete from the top. This mould was built similarly to a hinged flask standing on end, and was made large enough to allow of casting two switches at one setting. The mould was properly lined up, leveled and braced to prevent moving while tamping the concrete. The bolts for holding the switches in place were set in the concrete of the cell structure by means of a template on top of the mould, just as foundation posts for engines are set. The concrete mixture was one part Universal cement, two parts torpedo sand and three parts screened limestone, which would go through a ⅜-in. mesh. After the mould was constructed, the only skilled labor required was that of the carpenter, who lined up the mould each time it was moved into a new position. After the concrete had set approximately 48 hours, the mould was stripped and again set up for the next two switches. After all the switches of a row had been cast, and the moulds removed, the cement worker went over them to point up any voids which might have occurred in the corners, and to give the whole structure a finished appearance. The result was a pleasing one. It was decided that the mould—which in this case was built of dressed lumber, in the attempt to give a smooth and finished appearance to the concrete work—might better have been of rough lumber, in which case it could have been built for about $50. In case a large number of switches were to be built, however, the speaker would recommend the construction of a metal mould, which perhaps would cost $100. A mould constructed of metal would be free from liability to warp, which always exists in the case of a wooden mould.

The wires leading from the oil-switches were separated from each other by means of barriers built up of thin slabs of concrete. The method of construction of these barriers was simple and effective. Pipes, or 0.5-in. rods, were set up and tied together with wire in the form of the proposed compartment construction. A light metal lath, such as is used for plaster partitions in building construction, was then wired to the light framework. A cement mortar was then applied, in the same way as the plaster. The cement worker became so expert in doing this class of work that he could build these compartments more rapidly than a draughtsman could make the drawings for them.

The bus-bar structure was built up in the same way as was the cell structure for the oil switches. Where lines left the building, or where they were run in any horizontal position, barriers were suspended from the ceiling by allowing a piece of metal lath to project down at the time the floors were put in. The barrier was plastered to this piece of lath in the same way as just described. Where conductor wires were taken through the floor, which, of course, was frequently necessary, the insulators were set into the concrete as the floor construction progressed; therefore, when the floor and switch construction was completed the wiremen had the insulators through which the wires were to be run properly located. One great advantage of this form of construction rests in the economy of space which it makes possible. Any brick wall must necessarily be 4 in. thick, whereas a concrete wall may be put up only 2 in. thick, provided it is reinforced. In case brick construction is employed, where thin partitions are desired, they must be built of soapstone or marble. The concrete is just as effective in most cases, and is much cheaper.

In constructing the switch cells and bus-bar structures, an attempt was made to obtain a perfectly smooth finish by dressing the mould smooth and coating it with shellac, as is customary for patterns. This was found to be a mistake, as the bubbles of excess water contained in the web mixture tended to gather on the smooth surface and make a rough finish to the work. It was found preferable to leave the mould rough and to finish the work with a final float-coat.

The generator leads were brought from the machines in 3-in. bituminized fibre conduits, laid in the cement floor of the basement. Under the generator switches, they were brought from the basement floor to the engine room in a solid concrete wall. The lead sheathing was removed from the cables, and additional coating consisting of paper and shellac was provided. After allowing a few days for this to dry, the cables were built into a wall of concrete. Inasmuch as the wall was only a few inches thick, little difficulty would be encountered in cutting the cables out, if necessary; in fact, three cables were cut out, under the mistaken impression that they were improperly connected. Little difficulty and slight expense were involved in the operation, and the cables were found to be in perfect condition. In the basement, no important wire or cable was permitted to be exposed. The result is that if a fire should start in any material which might be stored there it could not affect the connections to the generators or instruments, nor could it cause the collapse of the structure, due to the failure of exposed steel columns.

The instrument leads and the control wires for the switches are buried in cement. It was originally intended to use for this purpose lead-covered cable run in an iron-armored conduit, the latter being imbedded in the floors. It was decided later, however, to do without the iron-armored conduit, and to lay the cables directly in the cement floor. For this purpose, a top coat of 2.5 in. of cement on the floor was allowed, in addition to the original cement floor which was designed to support the full loads. Of this top dressing, 2 in. consisted of a mixture of cement, sand and sawdust, in the proportions of one of cement, one of sand and two of sawdust. The method of installation consisted of laying the conductor cables on the top of the original supporting floor. When all the instrument wiring was completed and tested, the cables were covered and imbedded in this mixture of sawdust-cement, and on top of all was laid a 0.5-in. finishing coat for the floor. The mixture of sawdust-cement is soft enough to permit of chopping a cable out at any time without damage to the cable, or to surrounding cables. The repair of the floor is very simple, and the floor is perfectly solid and to all intents and purposes the same as if constructed wholly of concrete. The necessity for chopping out cables is very remote, because, once properly installed, there is no chance for movement or damaging of the cables. The item of labor saved by making it unnecessary to draw into the conduit the very great number of cables which are required for the installation of electrically controlled switching apparatus is very considerable.

The 20,000 volt wires which were led from the transformer room on the first floor to the lightning arresters and building outlets on the top gallery were provided with thorough protection where they passed through the operator's gallery. For each wire a chimney was built of 10-in. bituminized fibre conduit. The three chimneys carrying the three wires of a circuit were placed close together and were surrounded with a construction of expanded metal lath, covered with cement plaster. The result was to outward appearance, a rectangular column. In effect, there was a thoroughly insulated duct provided for the conveyance of each high-pressure wire, which acted to prevent entirely the possibility of an operator coming into contact with these wires in any way.

After the installation of all apparatus and connections thereto, the cement work was given a final finishing wash of whiting, glue, and a slight amount of dark coloring matter, producing a uniform cement color over the whole job. It is impossible to produce this without some such wash, since all cement work will discolor more or less as it dries out.

The final result is most pleasing from both engineering and artistic standpoints. Not much effort was taken at the start to lay out the work with a view to insuring good architectural lines, but even though this was not looked to as it might have been, it was possible, by adding a touch here and there, to get some very satisfactory effects from the standpoint of appearance. Of recent years, most large power-houses are designed with a view to obtaining good architectural lines on the exterior, whereas the interior is generally designed from an engineering standpoint only. The possibilities of cement construction in insuring artistic and decorative interior effects, with very slight increased cost, and without sacrificing engineering requirements, have so far received too little consideration.

Pensions on the Pennsylvania R. R. have now been paid to retired employes for five years. In 1900 the amount spent was $244,020 and in 1904 it was $390,000, not including the cost of managing the department. During this period 2,418 employes have been retired on pension, 568 between 65 and 69 years of age. Most of them retired at their own request, with the approval of their employing officer.

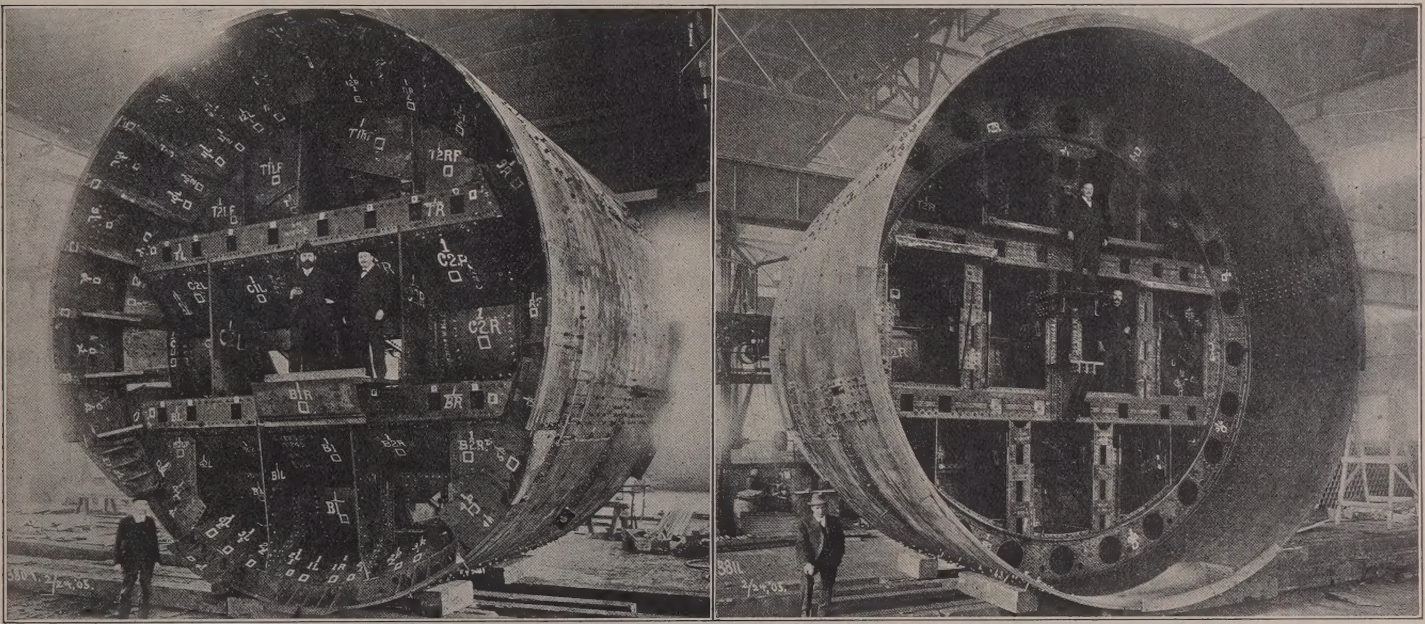
Shields for the Pennsylvania Railroad Tunnels under Hudson River.

In the description of the Pennsylvania Railroad Company's project for entering New York, printed in this journal on Oct. 10 and 17, 1903, it was stated that there would be two tunnels under the Hudson River. These are being worked from both the New York and New Jersey sides and four shields are therefore required. These shields are 24 ft. 6 in. in diameter and 16 ft. long, not including the roof, which overhangs 30 in. around two-thirds of the diameter to protect the workmen from cave-ins. The shells are made up of three thicknesses of steel plates, the inner and outer plates being ¾ in. thick and the center one ⅝ in. thick. The butts all come out at different places in order to develop a maximum strength of the combined plates. At the butts there are six lines of closely spaced rivets and the entire shells are stitched with countersunk rivets about 12 in. centers.

The cutting edge is reinforced with a heavy steel casting made in segments with machined bearings against the shell. Back of the steel casting there is a nest of brackets which in addition to reinforcing the cutting edge act as a seat for the twenty-four hydraulic jacks that are spaced directly inside of the shell incased in steel pockets which form a circular girder to further strengthen the shell, and inside of this rim there are horizontal and vertical girders, between which there are nine gates, two in the top tier, four in the center tier and three at the bottom. Immediately under the top and center tiers there are eight hydraulic rams which carry movable platforms. The shields were built by the Riter-Conley Manufacturing Co.

In the operation of the shield the workmen enter the bottom tier of gates and cut away the earth, throwing it through the gates to tram cars. As soon as the earth is cut to sufficient height to allow the first platform to be moved out the men enter the center tier and cut away the earth until the second platform can be moved out. They then get within the upper tier and cut away the balance of the space, giving the shield a free space to advance about 3 ft.

The finished cast-iron sections of the tunnel are always put in place up to the point lapping inside the shield, a distance of about 18 in., and when ready to advance the shield another space the hydraulic jacks are thrust against the last set of cast-iron linings, which pushes the shield forward and at the same time gives clearance for another set of linings. These are placed in position and the work of cutting away in front of the shield for another advance proceeds.



Front and Rear Views of One of the Shields for Use on the Pennsylvania Railroad Tunnels under the Hudson River.

Victoria Falls Bridge over the Zambesi River, Africa.

The Zambesi River is one of the largest rivers in Africa, and flows through a country which promises to afford great commercial wealth. Near latitude 18° south and longitude 26° east the river has a width of more than 1 mile, and suddenly drops over a precipice 420 ft. high, at the foot of which it makes a turn of 90° and flows for 45 miles with a width of 150 to 300 ft. through a narrow and tortuous rocky canyon. Less than 1,200 ft. below the falls the Rhodesian Railway Company has just built a 2,000-ton double-track bridge across the canyon about 420 ft. above the water. At this point the perpendicular river banks are of basalt, and support a spandrel-braced steel arch of 500-ft. span. Although there are several arches of longer span and one or two structures of equal or greater height, no bridge has a span with combined length and height equal to this, and its successful erection is a matter of much interest.

Both in location and in general design the arch bears a striking resemblance to that across the Niagara gorge just above the Whirlpool Rapids, except that it is a single instead of a double-deck structure like the latter. The trusses are battered 1:8 from the vertical. They are 105 ft. deep at the skewbacks and 12½ ft. at the crown, where they are 27½ ft. apart on centers. The top chord is horizontal and the bottom chord is a parabolic arc with a rise of 90 ft. The skewback pins are 53 ft. 9 in. apart transversely on centers of trusses and the trusses are divided into 20-ft. panels, the top chord being cambered 9 in. at a temperature of 60 deg. Short deck spans connect the ends of the arch trusses with the abutments.

Details of the structure are not now available, but the general illustrations published in the "Engineer," of London, indicate that all connections are riveted, excepting at the skewback hinges. These are apparently made with riveted steel shoes with six triangular webs with half-hole bearings for the hinge-pins. The base of the shoe is normal to the resultant reaction, and is seated on a grillage of plate girders anchored to a massive concrete pier.

The bridge steel was shipped from Middlesbrough, England to Beira, on the east coast of Africa near the mouth of the Zambesi, and thence by rail to the site, a total distance of about 8,000 miles. All the material was delivered on the south side of the river, and half of it, together with the materials for 50 miles of the railroad under construction to Kalamo, was transferred to the opposite side of the canyon by a cableway of 900 ft. span, with a steel tower 36½ ft. high at one end and a pair of steel shear legs 79 ft. long pivoted on their base at the other end. The shear legs are movable, and adjust themselves to the load on the cableway. The cable is a steel wire rope 2.7 in. in diameter, which was hauled across the canyon by the last of several lines, each stronger than the preceding, the first of them being carried over the chasm by a rocket. The electric trolley hoist has a capacity of 10 tons, and is operated by a motorman on its platform. This plant was erected and tested at the contractor's works in Darlington before being shipped to the site.

The arch trusses were erected by the guyed cantilever method from both sides of the canyon at the skewback points and providing for the horizontal reactions in the top chords by anchoring their ends to the shore. This was accomplished with continous steel cables led from the end of one truss to the foot of a vertical shaft 30 ft. deep, then through a transverse tunnel 30 ft. long to the foot of another vertical shaft, up through it and back to the end of the opposite truss, thus utilizing the solid rock for reaction, which was reinforced by 500 tons of rails piled on the surface between the horizontal portions of the cable. It was assumed that each cable would sustain a maximum tension of 400 tons, and as the erection progressed additional ropes were connected to the trusses.

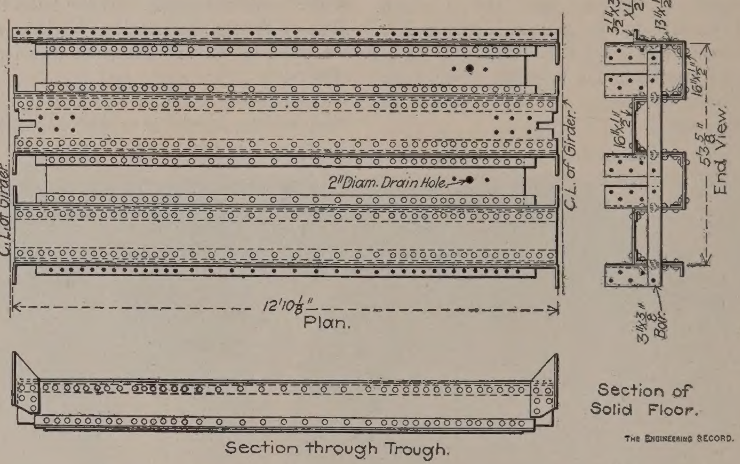
The truss members were assembled by a steel traveler moving on the finished top chord and connecting one panel in advance with a pair of steel booms. The traveler has a horizontal platform, with a triangular longitudinal truss in the plane of each arch truss. The long vertical posts at the forward ends of the trusses served as derrick masts and were connected by transverse horizontal and diagonal braces. The tackles were apparently operated by electric hoisting apparatus.

Erection was commenced October 14, 1904, and the bottom chords of the semi-arches were connected at the crown April 1, 1905. The difficulties of erection were increased by the fact that during the flood season, from February until September, the bridge was enveloped with spray from the falls, and this condition, together with climatic troubles, made it difficult to employ men not acclimatized. Twenty-five erectors were sent from England, but most of the work was done by a force of about 100 blacks. The bridge was designed by Sir Douglas Fox & Partners and Sir Charles Metcalfe, engineers for the Rhodesian Railway Co., and was built and erected by the Cleveland Bridge & Engineering Co., Ltd., of Darlington, England.

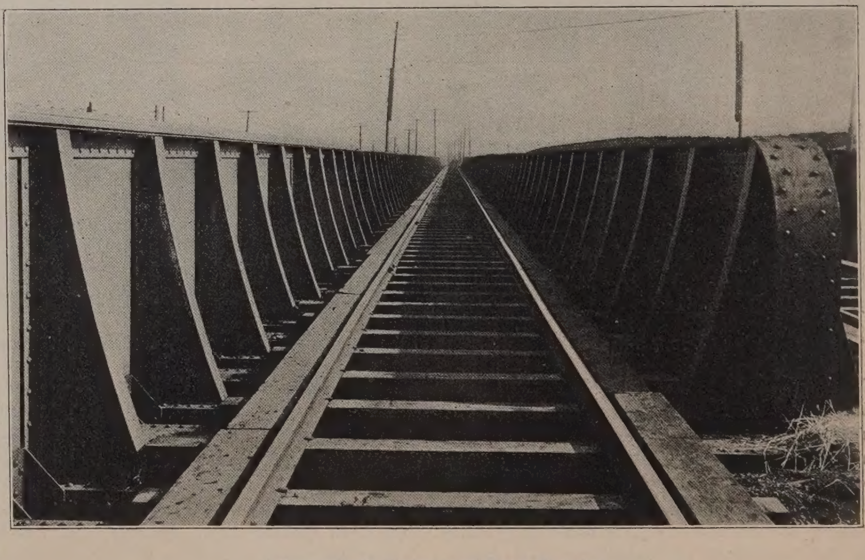
Silt and Sand in the Water Supply of Harrisburg have caused considerable damage to the water-works pumps, and two cart loads of silt can generally be found in the valve chambers after a comparatively short run under ordinary conditions. A suction valve in one of the pumps was found at the end of a 24-hr. run to have been cut entirely adift by damage to its fastenings by scouring substances which had passed through the valve gratings.

The Southwestern Ave. Boulevard Nine-Track Viaduct in Chicago.

The track elevation improvements in Chicago have necessitated the construction of an unusually wide viaduct to carry four tracks of the Pittsburg, Chicago, Cincinnati & St. Louis Railway, two tracks of the Chicago Terminal Railroad Co. and three tracks of the Chicago Junction Railway Co. across the intersection of the Southwestern Avenue Boulevard and West Thirty-ninth Street at a considerable skew with both streets. The viaduct is about 631 ft. long on the skew, and about 155 ft. wide over all perpendicular to this dimension. It is really divided into two independent parallel structures, one carrying four tracks for the use of the P. C. C. & St. L. Ry. Co., and the other carrying five tracks for the other two companies, and separated from the first by a space of about 40 ft. in the clear.



Section of Solid Floor.



Intermediate Girders and Sway Bracing.

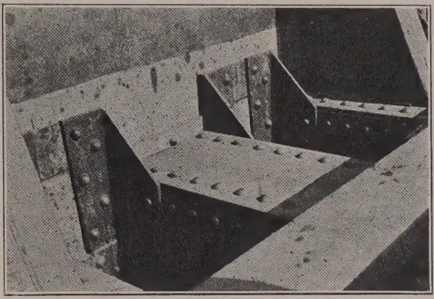
The structure includes 107 through plate girders of about 32 to 79 ft. span, which are supported on the end abutments at the outer edges of the boulevard sidewalks and on 95 steel columns about 14 ft. high. In each street the columns are located on the curbs and on center or intermediate lines parallel to them, and as the angle of intersection of the streets is not exactly 90 degrees, nearly all the spans differ in length, some of them only a small amount, and there are very few duplicate girders or uniformly located columns, thus making great complexity of construction. West Thirty-ninth Street has a 40 ft. driveway and two 13 ft. sidewalks and is crossed in some places by single spans of about 48 ft. reaching from curb to curb, and elsewhere by two spans supported on columns in the centre of the driveway. The Boulevard and Southwestern Avenue have a total width of 240 ft., made up with four lines of sidewalks, two driveways and three parked strips, and the columns in it, except in the intersecting street, are arranged at the intersections of lines parallel to its center line and to the center line of the viaduct. By this arrangement all obstruction to traffic is avoided except by columns on the curb lines and a few on the center lines of 40-ft. driveways.

The location of columns, abutments and girders and the general arrangement of the viaduct is indicated on the general diagram, where the column centers are shown by small circles, and the center lines of the girders are broken with single dots. The sub-structure is of concrete. The column footings are proportioned for a maximum load of 4,000 lbs. per sq. ft. on the clay soil and are carried down to a depth of 12 ft. below the curb. They are 12 ft. square at the bottom, offset to 5 ft. at the top and capped with granite blocks. On the north side of the Boulevard six lines of girders are arranged 13 ft. apart on centers in one group and on the south side an entirely separate group of five lines is arranged 13 ft. apart on centers. At the inner edges of the boulevard driveways there are expansion joints in the viaduct, with one fixed and one sliding bearing for the girders supported on the columns there, all other bearings for the girders being fixed both on the columns and on the abutments.

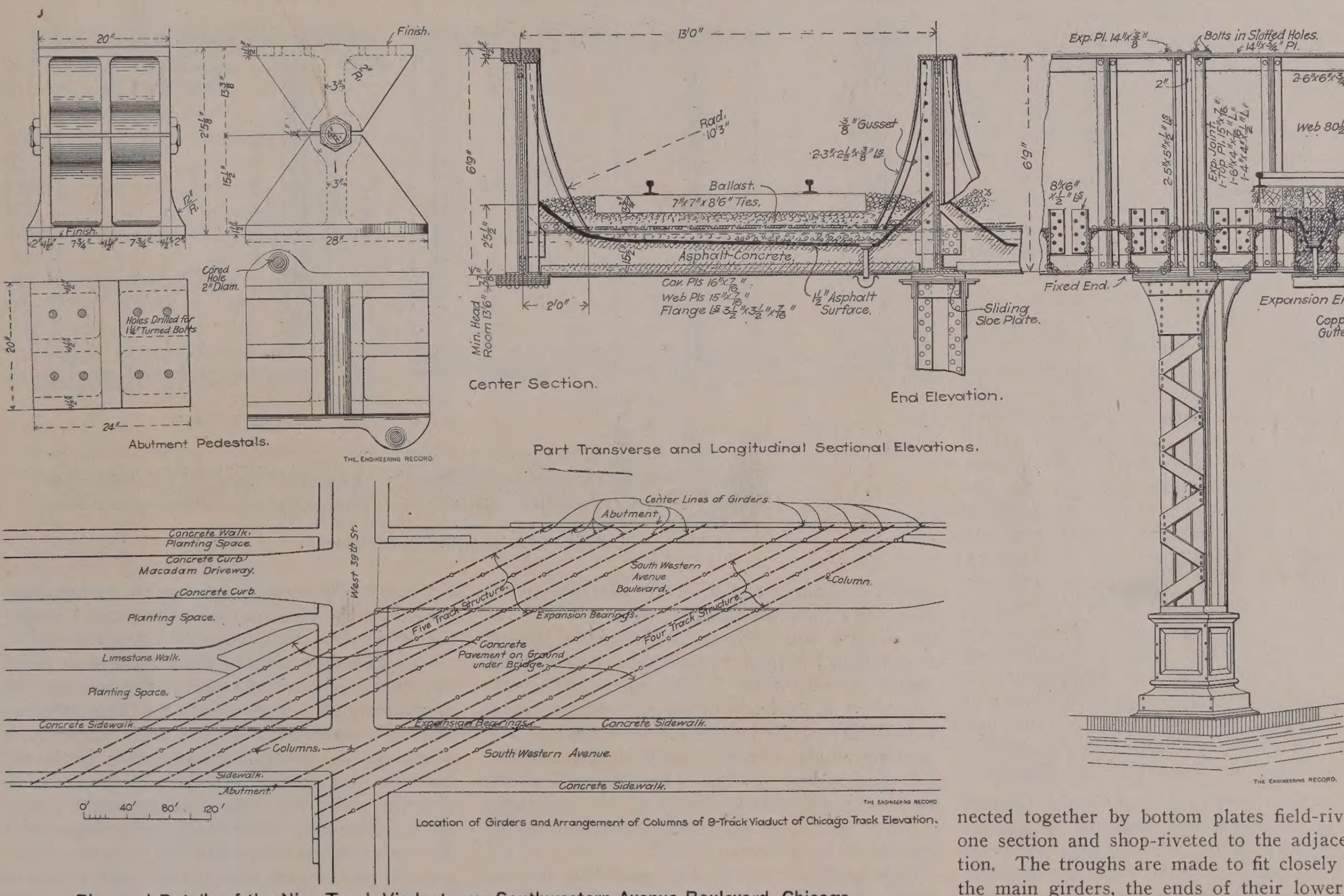
The girders are of simple, ordinary construction, with full length plates and angles in the T-shaped flanges so that splices are required only for the web plates, which are made in as long pieces as practicable. At the abutments the upper corners of the girders are rounded to a radius of 26¼ in., elsewhere they are square. Not more than three sections of web plates are used in any span and in the long spans these plates have their edges cut to a slight angle in the two end sections only, so that these plates are oblique angled parallelograms and when fitted with the square ends of the center section of plate produce a center camber of about 13/16 in. The rivet lines are laid off on circular curves making versed sines of 3/32 in. with the edges of the plates. The girders are divided into panels, with a length approximately equal to their height by vertical web stiffener angles composed of pairs of angles on each side where they engage transverse sway brace gusset plates, and single angles where there are no gusset plates, all of them being provided with filler plates and having their ends finished to bearing on the flange angles. The gusset plates are peculiar in having their outer inclined edges curved and are stiffened with pairs of flange angles on the horizontal and inclined edges.

The superstructure was designed under the specifications for railway bridges of Pennsylvania lines west of Pittsburg, of April, 1897.

A 79½-ft. girder, supporting one-half of one track, has a calculated span of 78 ft. and effective depth of 81 in. The assumed dead load is 2,400 lbs. per lin. ft. and the live load is 25,000 lbs. concentrated plus 2,500 lbs. per lin. ft. The total calculated moment is 50,567,400 in-lb., flange stress 624,300 lb. and the required net area of tension flange, 54.46 sq. in. The end shear is 93,600 lb. minimum and 216,100 lb. maximum; the required web area 32.78 sq. in.; the web used being 80½ x 7/16 in., required end rivet pitch 2.15 in., for which a 2-in. staggered pitch was used. The bottom flange is made with two 6 x 6 x ¾-in. full-length angles, one full length 20 x ¾-in. cover plate, one ⅝ x 56½-ft., one 9/16 x 44 ft., and one ⅜ x 28½-ft. cover plate, all 20 in. wide. The top flange has the same gross sectional area and is made up with two 6 x 6 x ¾-in. full-length angles, one ¾-in. full-length, one ¾ in. 59½ ft., one ⅝ 50 ft., one ⅝ 40½ ft., and one 9/16 28-ft. cover plates, all 14 in. wide. The intermediate girders, from 71 to 76 ft. long, which support one track, have additional 16 x ½-in. vertical plates in their flanges. All spans have flange plates and angles of the same widths. Web plates vary from ⅜ to 11/16 in. thick and have a uniform depth of 81 in. back to back of angles for all spans.



Floor Trough Connections.



Abutment Pedestals.

Center Section.

End Elevation.

Part Transverse and Longitudinal Sectional Elevations.

Location of Girders and Arrangement of Columns of 9-Track Viaduct of Chicago Track Elevation.

Plan and Details of the Nine-Track Viaduct over Southwestern Avenue Boulevard, Chicago.

All girders have 20-in. sole plates, ⅞-in. thick riveted to the bottom flanges at both ends. At the fixed bearings these sole plates are seated directly on the column caps, to which they are secured by four 1¼-in. turned bolts, except at the abutments where they rest on cast-steel shoes and pedestals providing hinged bearings to allow for deflection and avoid concentrated eccentric pressure on the masonry. Transverse slots are planed in the sole plates to engage ribs on the center lines of the shoes, and the bearing plates of the latter are finished and are bolted to the girders. The shoe has three longitudinal webs and a continuous semi-circular pin bearing, supported by a transverse web. The pedestal is like the shoe reversed, except that the base is enlarged and has extensions on opposite diagonal corners of the base plate to receive 1¾-in. anchor-bolt holes. The shoe and pedestal are not locked together, but have a ½-in. clearance on the 3⅞-in. bearing pin. The cast steel in the pin bearing shoes is required to develop when tested an ultimate tensile strength of 65,000 lb. per sq. in., elastic limit of 33,000 lb., elongation of 15 per cent. in 2 in., and a reduction of area of 20 per cent. at the point of fracture. At the expansion ends of the girders as well as the fixed ends over the columns the sole plates have longitudinal center slots planed in them to engage guide ribs on the bed plates riveted to the tops of the columns. The pedestals are seated on sheets of soft lead interposed between them and the granite coping of the abutment masonry.

The spans have no floorbeams, stringers or lateral systems. The girders are connected only by the transverse plate and angle troughs of the solid ballasted floor system. The troughs are 16½ in. wide on centers of webs and 13½ in. deep, made with ½-in. plates and 3½x3½x½-in. angles, and are shop-riveted together in sets of three, four or five, so as to form sections up to about 9 ft. long. These sections are connected together by bottom plates field-riveted to one section and shop-riveted to the adjacent section. The troughs are made to fit closely against the main girders, the ends of their lower angles being cut to clear the edges of the flange angles and to take bearing on the upper surfaces of the flange cover plates. The troughs are connected to the girders by short vertical angles shop-riveted to the end of each web plate with five rivets, and field-riveted to the girder web with five rivets. All rivets are ⅞-in. diameter, and the holes for field driven rivets were punched ¾ in. and reamed in the field after assembling. The under side of the troughs only was painted in the shop with one coat of boiled linseed oil. After erection the troughs were filled with asphalt concrete rounded up to a height of about about 2½ ft. on the girder webs, where it makes a smooth curved fillet, reaching to the top flanges of the troughs and sloping thence about 4 in. to short 1½-in. vertical pipes, projecting through the bottom plates of the troughs at one end with their tops flared out to receive drainage at the surface of the concrete. They discharge into copper gutters attached to the under sides of the troughs and connected with leaders on the columns. The concrete filling has an asphalt surface 1½ in. thick, and is covered with broken stone ballast, in which the 7x7-in. ties are laid with their upper surfaces 13½ in. above the bottom plates of the troughs.

The trough floor is designed for a dead load of 3,500 lb. and a live load of 5,000 lb. per lin. ft. of track, plus a concentrated live load of 50,000 lb., the uniform live load being assumed to be distributed over a width of 8 ft. transversely, and the concentrated load over 8 ft. transversely and 4 ft. longitudinally. The maximum total moment thus produced is 711,138 in.-lb., and the corresponding cross sectional area is 21 sq. in. The end shear in the trough is 13,800 lb., and the flange rivets are pitched 3 in. for 4 ft. at each end and 6 in. in the middle. All material in the viaduct is of medium open hearth steel except the soft open hearth steel shop rivets and the wrought iron field rivets. All rivet holes are subpunched and reamed.

The columns have rectangular cross sections made up with pairs of built channels, latticed on both flanges. They are made with 18-in. web plates and 4x4-in. angles and their cap plates are of double thickness, the upper plate having a longitudinal rib planed on the upper side and riveted to lower plate at an oblique angle with the center line of the column so as to be in line with the girder. At the feet of the columns the lattice bars are replaced by flange cover plates about 3½ ft. long, which are enclosed by light cast iron moulded panels, making ornamental pedestals.

Before the construction of this viaduct a traffic of more than 20 trains per hour on the average was maintained on a temporary wooden trestle viaduct, which was removed as fast as the steel structure was put in service. The steel work weighs about 4,420 tons, and its erection was commenced August 22, 1904, and completed March 14, 1905. About 126,000 ⅞-in. field rivets were driven and their holes were reamed at the site by Chicago Pneumatic Tool Co.'s tools operated by two 12x12-in. Franklin air compressors. An Ingersoll-Sergeant Little Giant drill was used for making the anchor bolt holes in the pier masonry, and the girders were erected by two locomotive derrick cars with 50-ft. booms of 25-ton capacity, and each equipped with a Lambert standard double drum 10x12-in. hoisting engine.

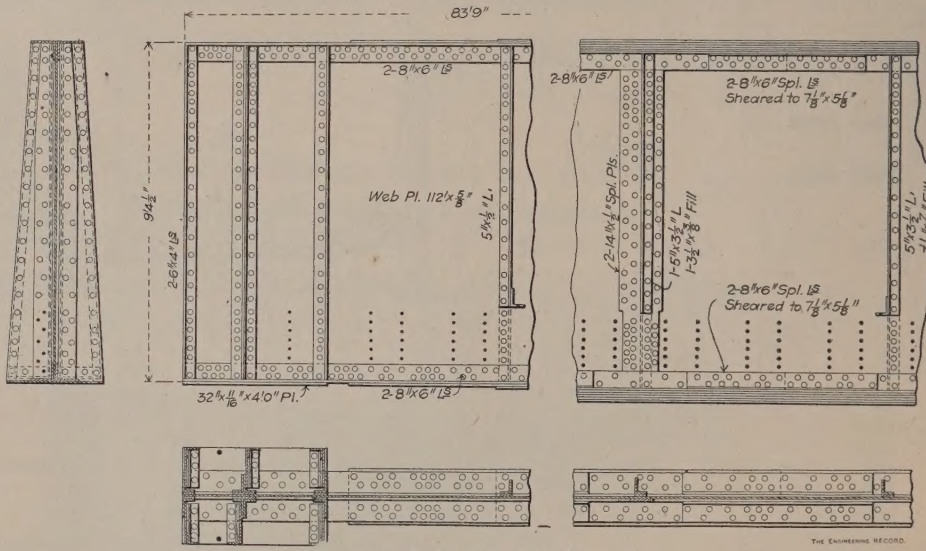
The steel work was fabricated in the shops of the Riter-Conley Manufacturing Co., and was erected by the Pittsburg Construction Co., and inspected by Robert W. Hunt & Co., of Chicago.

Locking-Bar Pipes, described in this journal on Feb. 24, 1900, have been employed on a 32-in. main at Sydney, N. S. W. In such pipes the edges of the plates forming them are upset or bulged slightly. The longitudinal joint is made with a bar of H-shaped cross-section. The edges of the plate are inserted in the slits, and the bar is then closed down on them, locking the edges together. The transverse joint is made with a sleeve and lead filling. Mr. L. A. B. Wade, the engineer in charge of the rivers, water supply and drainage works of New South Wales, states that some trouble was experienced in making the transverse joints, owing to inadequate space for running and calking the lead. At one place, where the main is under 75 lb. head, a jet of water passed between the locking bar and the lead, at a sleeve, in such a way as to be deflected downward and thus gradually eroded a hole in the ⅜-in. steel plate.

The Lebanon Valley Double Track Skew Plate Girder Bridge.

The double track through plate girder span which carries the two tracks of the Reading Belt Railroad over the Lebanon Valley Crossing, is typical of recent standard practice of the Philadelphia & Reading Railway Co. There are two girders 83 ft. 9 in. long, and about 10 ft. deep over all, which are considerably skewed and have an unusually deep solid floor at lower flange level, which is kneebraced to the top flanges and dispenses with floorbeams, stringers and lateral diagonals. The girder web is made of 112x⅝-in. plates in sections from about 20 to 22½ ft. long, spliced by pairs of 14x½-in. cover plates with four vertical rows of rivets. They are stiffened with pairs of vertical angles, those on the inside being cut to clear the floor troughs and fillers. These divide it into panels of a uniform length of 6¾ ft., except at the ends where they are shorter and there is a double pair of angles nearly over the centers of the bearings, and there are three pairs of transverse vertical plates which make a heavy compression member and give increased stability by widening the base.

The maximum flange section is made with two 6x8x⅞in. flange angles, two 18x⅞-in. cover plates and three 18x13/16-in. cover plates. The cover plates are made in single lengths, having a maximum length of 74 ft. 1½ in. and the flange angles are each made in two pieces, 44 ft. 11½ in. and 37 ft. ¼ in. long, breaking joints on opposite sides of the web in the same flange. The splices are opposite each other in the top and bottom flanges, four in all, at each end of the girder, each of them, although covering but one angle, is made with two 6x8x¾-in. angles sheared to 7⅛x5⅛ in. to act as covers.



Details of Girder with Floor Removed.

The bearings at both ends are alike and are made with 32x11/16x48-in. planed sole plates, which project 7 in. each side of the flanges, and have their edges stiffened by bearings on the bottoms of the three transverse vertical gusset plates riveted to the web stiffener angles. The rectangular floor troughs are made with plates and angles and are 23½ in. deep, and 11 in. wide, and are connected to the girder webs with six field rivets in a vertical angle shop riveted to each end of each side plate. The girders weigh about 38 tons each, inclusive of about 46,000 lbs. of cover plates, and were riveted up complete in the shops, leaving only the floor trough and gusset plate connections to be field riveted.

The Phœnix Bridge Co. was the contractor for the superstructure, which was designed and constructed under the direction of the Engineering Department of the Philadelphia & Reading Railway Co., Mr. W. Hunter, chief engineer.

The Development of the State Highway System of Rhode Island.

Presented before Section D of the American Association for the Advancement of Science, at the Philadelphia meeting, Dec. 30, 1904, by A. H. Blanchard, Assistant Professor of Civil Engineering, Brown University.

At the January, 1902, session of the Rhode Island general assembly an "act to provide for the construction, improvement and maintenance of the state roads" was passed. The passage of this act was the first tangible step towards the development of a state highway system. It should not be construed that Rhode Island had not, previous to this time, enacted legislation relative to state aid in highway improvement, for in 1896 and 1897 sample half miles of macadam road were built under the direction and at the expense of the state "to demonstrate the modern methods of building macadam roads and in order that the advantages of good roads should be appreciated by the people throughout the state." The act of 1902, under which state highways have been built since the spring of 1903, insures the completion of a system of continuous highways traversing every portion of the state, provided the general assembly continues to pass adequate appropriations.

The salient features of the act differ in many respects from those of other state laws, and are therefore worthy of consideration. The construction and maintenance of the state highways is in charge of a state board of public roads, the members of which are appointed by the governor with the advice and consent of the senate, one of the five members of the board being reappointed or a new member appointed for a term of five years at the January session each year. The engineering work is in charge of a chief, appointed by the board, who has under him a corps of office and field assistants and road inspectors.

By far the most important section of the road law is that which provides that the entire expense of building and maintaining a macadam road of standard cross-section, having a macadam surface 14 ft. wide and 6 in. thick, is to be borne by the state. The advantages accruing from this wise provision are many. First and foremost, it insures a system of highways built in accordance with the best judgment of the board and the general assembly for the benefit of the whole state. Second, the engineering work may be kept entirely under the control of the board, beginning with the preliminary survey and ending with the continuous maintenance. Third, the state is benefited vastly more by a system of continuous highways traversing the entire state and connecting with the main arteries of travel in neighboring states than by a heterogeneous collection of short sections leading to nowhere in particular, the usual result of the petition system. Fourth, as 90 per cent. of the trunk lines pass through or terminate in the large centers of industry, the cities are actually benfited to a greater extent proportionally than by the petition system, under which a certain percentage of the cost is paid by the towns or counties in which the improved highways are situated. The main reason for this advantage lies in the natural flow of the population and farmers' crops along the lines of least resistance, namely, the improved continuous highway, and also, from the standpoint of pleasure, the main avenues of travel opened to the urban population, whether they ride in automobiles, carriages, awheel or enjoy the beauties of the country side in the more humble role of pedestrian. The roads which form the state highway system comprise fifteen of the principal continuous highways of the state, having a total mileage of 249, 64 of which had been improved by the towns or by the state under the sample-half-mile act previous to 1903. During the year 1903, 18.89 miles of macadam road were contracted for, thus leaving 166.11 miles to be provided for after January, 1904.

An annual appropriation of $5,000 was included in the act, to be expended annually for clerk hire, for engineering assistance and for other incidental expenses; the members of the board, however, serve without remuneration. The appropriations for the construction and maintenance of the state highways are made annually, based upon the annual reports which the board is required to make to the general assembly during the month of January. In their first annual report in 1903 the board recommended "for the present year an appropriation of $100,000, to be followed by an annual increased appropriation of $25,000 for three years, and for the fifth and sixth years an appropriation equal to that made in the fourth year. By this plan of graded appropriations the whole work could be completed within a period of six years." The general assembly at the January session, 1903, appropriated $100,000, but due to extraordinary expenditures it was not thought advisable to appropriate more than $100,000 in 1904. The assembly of 1905 will, without doubt, appropriate from $100,000 to $175,000, the amount depending upon the number of special appropriations required for unexpected exigencies.

The section relative to the cost of extra widths is of such importance that it is quoted in full. "All main highways so improved by said board shall be constructed or improved to a width not to exceed 14 ft., exclusive of shoulders or gutters, except that any town or city desiring to have improved a greater width of such highway may agree in writing with said board for such additional width of improved main highway as it may desire, provided the entire expense of such additional width of improved highway be paid by such town or city to the general treasurer, to be credited to the amount available for the use of said board for the purposes of this act." During the year 1903 eight of the towns in which state roads were built took advantage of this provision, increasing the width of the macadam from 2 to 12 ft., thus giving total widths of from 16 to 26 ft., the total cost to the towns being $8,068.37. The widest road constructed in 1904 has a surface of macadam 32 ft. wide.

The actual construction of the macadam roads in Rhode Island is as yet in an experimental stage, many problems peculiar to Rhode Island having presented themselves. The standard road section consists of a macadam surface 14 ft. in width, 6 in. deep, composed of two courses, the lower being 4 in. of broken stone varying in size from 1¼ to 2½ in., the top being 2 in. of broken stone varying in size from ½ to 1¼ in., with screenings just covering the surface; the macadam is flanked with a 3-ft. shoulder of gravel or other firm material on each side, thus making a total surface of 20 ft. width, having a transverse slope of ¾ in. to the foot; the side slopes in both embankments and excavations at the edge of the shoulders have a fall or rise respectively of one in one and one-half.

A problem which every highway engineer has to deal with to a greater or less extent is what kind of rock to use for the courses; this problem is greater in states of which Rhode Island is unfortunately an example, in which trap rock exists in very limited quantities, and is less in states of which New Jersey is an example, where trap rock is found abundantly. Without doubt, the majority of traps make an ideal top course on roads subjected to heavy or average traffic, hence states supplied with this material are relieved of the complicated problem upon which the state board of Rhode Island and its engineers are diligently working. In some towns trap rock roads have been constructed, but these have been located adjacent to railroads, thus enabling a contractor who owned a trap rock quarry without the state to submit a proposal nearly as low and sometimes lower than the contractor who expected to use local stone. In the case of roads situated at from five to ten miles from a railroad, it would be absurd to transport trap rock at great expense until it had been fully demonstrated that the local stone would not make a satisfactory road. In investigating the value of the different rocks available for road metal in the state, the board has been aided by the information furnished by geological surveys and the Division of Tests, Bureau of Chemistry, U. S. Department of Agriculture. The results of the tests made in the laboratory at Washington are, in the opinion of the writer, of the utmost importance. These tests include the determination of the rock's specific gravity, weight per cubic foot, water absorbed per cubic foot, percentage of wear, French coefficient of wear, hardness, toughness, cementing value and mineralogical composition. By the knowledge obtained from these tests, together with information gained from observation on how the material actually wears and binds in practice, it will be possible to a certain degree to determine which stone will make a satisfactory lower course and what stone can be used as the top course and as binder. If the cementation value of all the rock in a community is low, it does not necessarily forecast the failure of a macadam road made of that stone, as it is possible to use in many cases different kinds of soil to act as a cementing agent. Why some rocks with a low cementation value will make an excellent surface and another rock giving identical results in laboratory tests will produce a surface that will ravel is one of the exigencies of road building yet to be solved.

The injurious effect of narrow tires upon road surfaces has long been recognized in Rhode Island, and in order to "regulate the width of tires upon vehicles using the highways of the state" an act was passed by the general assembly of 1902, which contained this important provision: "From and after April 1, 1905, no vehicle shall be used on any highway in this state unless the width of the tires on each of the wheels of such vehicle shall be proportioned to the sizes of the axle of such vehicle as follows:

Size of axle, in..........	1⅜	1½	1⅝	1¾	over 3
Minimum tire, in..........	1⅝	1¾	2½	2½	6

It is believed that a rigid enforcement of this act will materially reduce the cost of maintenance of the state highway system.

Before closing, the relation of trolley roads to state roads should be considered. With reference to existing roads, the relation in Rhode Island depends upon the town in which the electric roads are built, as the franchise is between the town and the electric railway company. One of the usual clauses in the franchise states that the electric railway company shall keep the highway for a width of 1½ ft. adjacent to the rail in as good condition as the adjoining surface. The result of this provision has been that many standard state roads have been built with a center 8½ ft. from the rail, resulting in a road having 15½ ft. of macadam instead of 14 ft. The advantage of this wise provision is not limited to an increase in the width of macadam surface, but equally important, the insured lateral surface drainage of the road, which advantage is of considerable moment on narrow roads where it is impossible to build a suitable gutter between the edge of the macadam and the rail, as has been done successfully in Massachusetts, for example. The electric street railways in Rhode Island have uniformly conformed to changes in grade and suggested changes in alignment, thus materially aiding in the satisfactory construction of macadam roads adjacent to electric railways.

The Design and Operation of a Modern Freight Yard.

The design and operation of a large freight yard is such a special feature of engineering work that many engineers will find some new information in a paper on the subject recently printed in the "Proceedings" of the Engineers' Club of Philadelphia. It was prepared by Mr. Joseph T. Richards, chief engineer of maintenance of way of the Pennsylvania R. R., and was illustrated by a plan of the new yard of the Washington Southern Ry. at Alexandria, Va., which it is unnecessary to reproduce. It needs only a glance at the statistics of the increase in railway traffic to appreciate the rapidly growing importance of both through and terminal yards. The freight business handled by the P., B. & W. R. R. at Washington, which is neither commercial nor manufacturing in character, has increased 110 per cent. in eight years. The business cared for by this line for southern connections shows an increase in this period of 350 per cent. from the Chesapeake & Ohio and 650 per cent. from the Southern and the Atlantic Coast Line. This business increase is an explanation of the reason for spending $7,000,000 in rearranging the tracks and terminals of the Pennsylvania and Baltimore & Ohio railroads in Washington, and it is typical of the conditions in many other cities.

In designing a yard, the fundamental problem is to secure an arrangement of tracks that will allow cars to pass through within the least possible time. The train arrives from the road, and, in passing into the receiving yard, the cabin in the rear is cut off on the lead track, at the switch leading to the cabin yard; the road engine continues with the train into the receiving yard, and, upon arrival there, cuts loose and goes directly to the engine yard; the cabin, in the meanwhile, having drifted into the cabin yard into a position ready to go out on the road in the opposite direction in its proper turn, the cabin tracks being graded to accomplish this movement. As soon as possible after arrival in receiving yard the train is inspected, the destination in the classification yard of the various cars is marked upon them, as well as the needed repairs to crippled cars which are to be thrown off into a separate track, known as a cripple track, and finally taken to the car repair yard. When the train is ready for classification, a pusher engine gets behind it and gradually pushes it over the "hump," the speed being about six miles an hour. As the cars pass over the "hump," a man stationed there, and known as the "cutter," separates them into "cuts" of from one to ten cars.

In marking the cars for classification, each "cut" of a draft or train is marked with its destination at the front end and the destination of the next succeeding "cut" at the rear end. This is for the benefit of the man in the tower operating the switches, so that he will have sufficient time to set the switches for each "cut" as it comes along. He is also furnished with a check list of each draft or train showing the "cuts" to be made, and the number of cars in each "cut."

The towerman in a two-story tower adjacent to the "hump," from which he can see the entire layout, operates the switches electrically by means of a push button machine, so that the cars will pass to the proper classification tracks. The speed at which the train is pushed over the "hump" is such that the cars, in running away from the "hump," usually are separated a sufficient distance from each other, that they will not foul one another when passing over the ladders, but in the event of too many "cuts" following the same ladder and thus getting too close, the tower is equipped with an air whistle or other signal under control of the towerman, by which he can regulate the speed movement of the pushing train. When a sufficient number of cars have accumulated in the classification yard (say, a train length) for any particular destination, or should the tracks of this yard become full, the cars are pushed out into the advance tracks or starting yard, where they are coupled up into trains and the air tests made. A road engine which has moved from the engine storage tracks couples up to the cars as they stand on the advance tracks, and pulls the train out on the main track, and in passing by the cabin yard a cabin is dropped out by gravity and coupled up to the rear of the train. The above process applies to trains in both directions through the yard. The cars pass over the "hump" at the rate of about eight a minute under ordinary conditions. To pass a freight train of, say, 80 cars through a yard as above stated, from the time of entering the receiving yard to leaving the departing yard, should not require more than two or three hours.

The incoming road engine, after it leaves the train in the receiving yard, first passes to the inspection pit, where a thorough inspection is given it, and, if repairs are necessary, a message is sent to the round house that engine No. —— will be placed in the round house for certain repairs. This gives the round house foreman an opportunity to have a stall ready to receive this engine. The inspection requires about five minutes. From the inspection pit the engine passes on to the ash pit, where the fires and the front end are cleaned, requiring, on the average, thirty minutes. The engine then passes alongside the coal wharf, where it receives its coal, taking up about one and one-half minutes; sand is then taken on at the far end of the coal wharf, and water at this same point. It takes from 1 to 2 minutes to fill the tank with water with the proper size standpipe. The engine then passes to the turntable, and if it is to be housed for repairs, it is placed in the round house. If no repairs are necessary, it is turned quickly and sent direct to the engine storage yard, where it awaits a call for power for a return train on the division from which it arrived. The average total time taken by an engine, where no repairs are made, from when it cuts loose from its train in the receiving yard until it is ready to take a train out on the road again, would not exceed one and one-half hours in a properly arranged yard. When a yard plan is not properly planned, an engine will take from four to six hours to make the same movement.

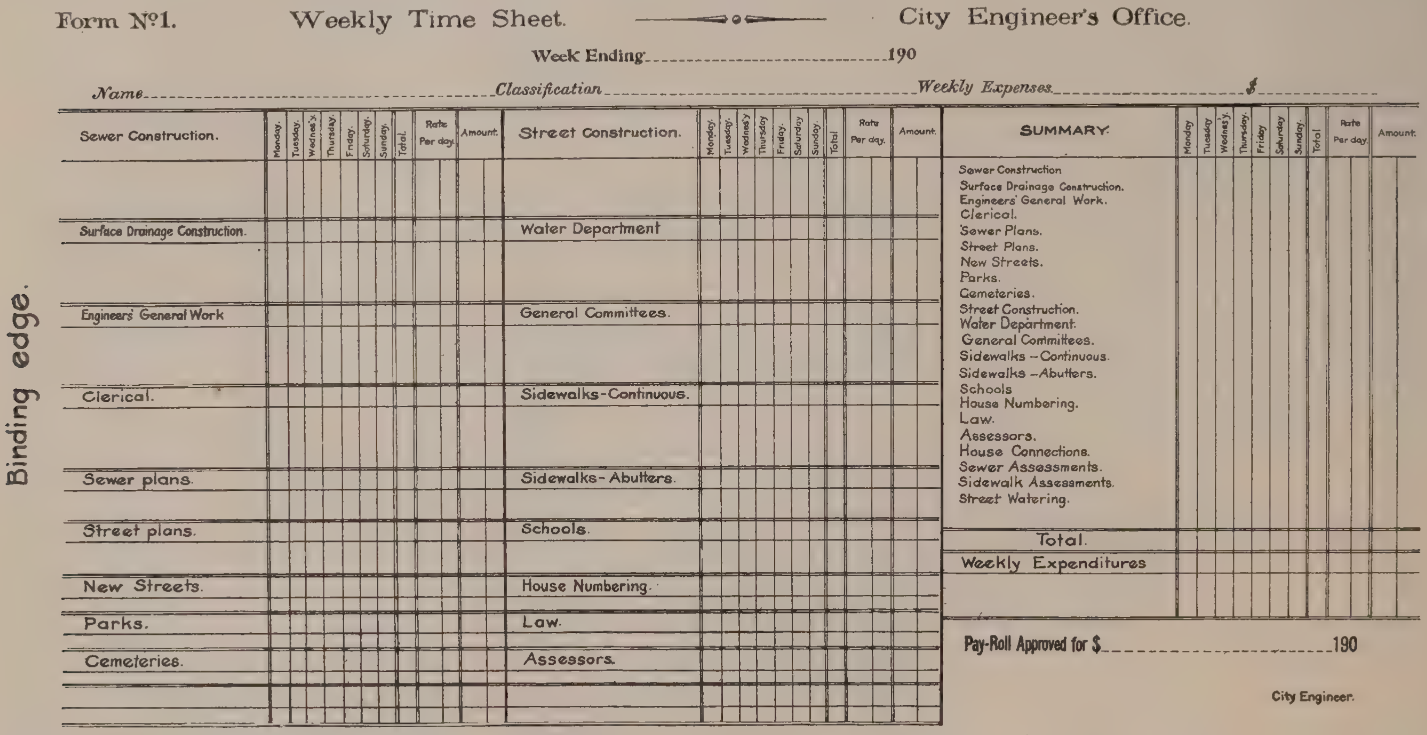
The Cost of Coal for Pumping Water at Harrisburg, Pa., with a new vertical triple-expansion high-duty Barr pumping engine, against a total working head of 245.83 ft., was found in the official test to be $1.42 per million gal. The pump has a capacity of 12,000,000 gal. and is furnished with steam at 140 lb pressure by three horizontal return tubular boilers with Wilkinson stokers. The fuel was of a low grade coal dredged from the bottom of the Susquehanna River and contained 17.53 per cent. ash and refuse. It cost about $1.50 a tone in the boiler room and Mr. Chas. A. Hague, consulting engineer of New York, stated in his report on the test that the coal consumption for the pumps was 1.98 lb. per indicated horse-power per hour. A new system of water-works is now under construction in Harrisburg from the plans of Mr. James H. Fuertes.

City Engineering Accounts.

Many suggestions have been published on the subject of keeping field notes, but very little has ever been printed concerning the method of keeping the accounts of the municipal engineering departments of small cities and towns. In such places most of the expense is incurred for salaries, and in order to subdivide the total expenditure properly, Mr. Christopher Harrison, city engineer of Everett, Mass., suggests the use of a special form on which each employe checks off daily the time spent on different classes of work.

This form is a sheet containing a number of columns. The left-hand column is reserved for the date and the others are headed surface drainage plans, sewer construction, surface drainage construction, general engineering, clerical, sewer plans, street plans, new streets, parks, cemetery, street construction, water department, general committees, continuous sidewalks, abutters' sidewalks, schools, house numbering, law, assessors, house connections, sewer assessments, sewer inspection, surface drain inspection, photography, house connection inspection, street watering, sidewalk assessments, registry of deeds, vacations and sickness, field work, calculations, plans and totals. These headings would naturally vary in each office, according to the work done by the engineering department. In making up the report, the employe enters the date in the left-hand column and then places, on the same horizontal line, in the proper columns, the entries of his time spent on that day on the different classes of work.

At the end of the week the pay-roll is compiled by the department clerk from these records of time. This weekly summary is kept in a book ruled as shown in the accompanying diagram. Such a system is suggested by Mr. Harrison as economical, concise and easy of reference when occasion requires a more specific amount of department work.



Form №1. Weekly Time Sheet. City Engineer's Office.

Week Ending ______________ 190

Name ______________ *Classification* ______________ *Weekly Expenses* ______________ $ ______________

Binding edge.

Sewer Construction.	Monday.	Tuesday.	Wednes'y.	Thursday.	Friday.	Saturday.	Sunday.	Total.	Rate Per day.	Amount.	Street Construction.	Monday.	Tuesday.	Wednes'y	Thursday	Friday.	Saturday	Sunday.	Total	Rate Per day.	Amount.
Surface Drainage Construction.											Water Department										
Engineers' General Work											General Committees.										
Clerical.											Sidewalks-Continuous.										
Sewer plans.											Sidewalks-Abutters.										
Street plans.											Schools.										
New Streets.											House Numbering.										
Parks.											Law.										
Cemeteries.											Assessors.										

SUMMARY.	Monday	Tuesday	Wednes'y.	Thursday.	Friday	Saturday	Sunday.	Total	Rate Per day.	Amount.
Sewer Construction Surface Drainage Construction. Engineers' General Work. Clerical. Sewer Plans. Street Plans. New Streets. Parks. Cemeteries. Street Construction. Water Department. General Committees. Sidewalks – Continuous. Sidewalks – Abutters. Schools House Numbering. Law. Assessors. House Connections. Sewer Assessments. Sidewalk Assessments. Street Watering.										
Total.										
Weekly Expenditures										

Pay-Roll Approved for $ ______________ 190

City Engineer.

Form for a Weekly Record of the Distribution of the Time of an Employee in a Municipal Engineering Office.

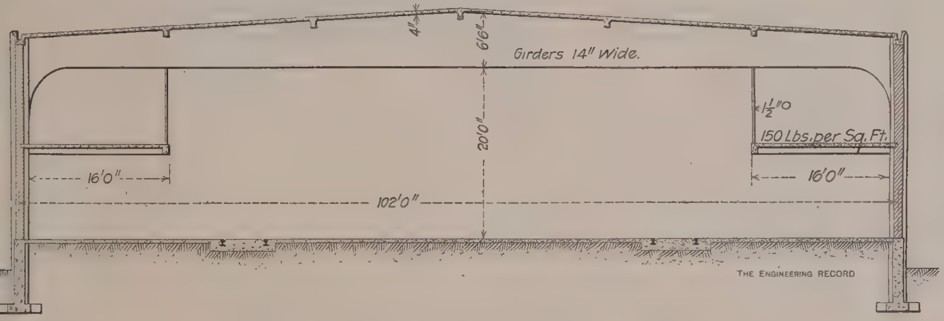
Stadia Slide Rules were used in reducing the data in twenty field books of notes of a stadia survey of the Coosa River and "proved of the greatest assistance." The work was in charge of Mr. N. A. Yuille, junior engineer, under Capt. J. B. Cavanaugh, Corps of Engineers.

A Reinforced Concrete Warehouse Roof.

By L. J. Mensch, Consulting Engineer, Chicago.

The Leonardt Warehouse in Los Angeles, Cal., ffords an interesting example of the adaptability f reinforced concrete. The building is 104x150 t. in size, and was intended originally to have 17-ı. brick walls with 25-in. piers, 16 ft. 6 in. on ceners, and covered by a steel truss corrugated iron oof of 100-ft span. The owner inquired of the riter whether it was practicable to build an arched einforced concrete roof instead of the steel contruction. Considering that the roof had to carry suspended gallery, and that means had to be rovided for lifting heavy weights and eventually o suspend tracks for light traveling cranes, the riter discarded the idea of an arched roof and ecided on straight girders of 102-ft. span.

The accompanying illustration shows a crossection of the warehouse as it was built. The girrs are 16 ft. 6 in. apart, 6 ft. 6 in. deep at the cener, and have a slope of 3 ft. towards each end. 'hey are 14 in. wide and reinforced at the botom by ten 1½-in. rods of medium steel, two of hich are straight, the others bent into a hoghain form, all secured to the concrete by 1-in. Io. 14 stirrups from 8 to 24 in. apart. The top is einforced by three 1½-in. rods, 66 ft. long. Heavy rackets connect these girders with 24x24-in. conrete piers, reinforced by five 1⅜-in. rods at the utside and two ¾-in. rods at the inside. This ave a skeleton construction and allowed of a reuction in the thickness of the walls to 12 in.



A Long-Span Reinforced Concrete Roof at Los Angeles.

Hollow concrete block walls were adopted, and ere carried by 14-in. concrete foundation walls ft. deep. These walls were enlarged at each pier, nd reinforced by ten ⅜-in. rods placed horizonlly near the top.

The ground consisted of loose sand, and, as erious settlements were found in nearby buildigs, only a ton per square foot was assumed as ie resistance of the ground. Therefore, the footigs for the walls were made 3 ft. wide, and those or the piers 7 ft. square, all 12 in. deep and reinorced by ⅜-in steel rods.

The savings in the walls and footings more than ounterbalanced the slight increase of cost of the oncrete girders over the steel trusses. The girers were connected by 6x11-in. beams reinforced y four ⅞-in. rods and covered by the 4-in. roof abs reinforced by ⅜-in. rods on 5-in. centers in oth directions. For the waterproofing an ordiary composition roofing was used.

There are six 6x16-ft. sheet metal and wire glass kylights in the building. Two galleries 16 ft. ide and 120 ft. long, are suspended from the roof rders by 1½-in. rods. These galleries consist of x12-in. beams, 16 ft. 6 in., on centers, and a 5-in. oor slab. They are figured for a load of 150 lb. er square foot.

The erection of the building was very rapid, and was built in a shorter time than the delivery of eel trusses could be figured on. It took about vo weeks to erect the centering and one week for e concreting. The concrete was mixed in the roportion of one part Iola or Colorado cement to 1½ parts of sand and 3 parts of crushed granite in the lower portion of the girders and 1:2:4 for all other parts. The girders of 102-ft. span are the largest ever attempted, and it is believed that there does not exist another fireproof roof of such a great span.

Electric Sewage-Pumping Stations at Sydney.

The sewerage system of Sydney, N. S. W., is rather unique for the large number of independent districts of which it consists. Some of these are so low that special interceptors and pumping stations have been built to prevent the sewage from entering the harbor. Mr. L. A. B. Wade, the engineer of the works, recently reported that seventeen of these stations had been finished.

In considering the most economical method of raising the sewage to enable it to flow by gravitation into the ocean, estimates of the different methods that might be employed were made, and it was found that the use of electrical power for this work showed very marked advantages, both as regards first cost and maintenance.

The electric power, which is supplied by the Railway Commissioners of New South Wales from their tramway power houses, is taken to central stations at Ultimo and Rushcutter's Bay and there distributed from switchboards to the various pumping stations, fifteen of which are controlled from Ultimo and two from Rushcutter's Bay. The operation of the system is as follows: The sewage, after being intercepted in the old sewers, is led to the underground pumping stations, which are provided with large tanks, into which the sewage flows. By means of floats, which rise and fall with the level of the sewage, automatic electric signals are sent to the central stations and enable the attendant there to see when the tanks are full, at the same time ringing a gong to attract his attention; the pumps are then started and the tanks pumped empty, when the signal is again sent to the attendant and the pumps stopped. A separate copper cable is led from the central station to each of the pumping stations in order to transmit power for operating the pumps, and the starting and stopping is accomplished by connecting or disconnecting these cables with the source of power. The stations are visited by attendants at regular intervals throughout the day, whose duties are to lubricate and keep the machinery clean and report by telephone to the controlling station. Altogether some 80 miles of cables have been erected to connect the pumping stations with the central stations; these comprise aerial weather-protected cables run on wooden poles, and underground lead and paper-covered cables, drawn into the ducts of earthenware conduits, laid under the footpaths and roadways of the city. The pumping stations themselves are situated below the level of the ground, being built of concrete where the nature of the ground would permit, but in many cases cast-iron caissons had to be sunk, on account of the bad ground and the excessive amount of water encountered in construction. These caissons are elliptical in plan, being 27 ft. long by 20 ft. broad and 24 ft. deep, weighing in all 80 tons each. They were erected above ground and then slung from a scaffold and lowered into position, the ground being excavated from the interior as the cylinders were lowered. Over some of the stations a small building has been erected, allowing light and air to the station below, but in some cases the stations had to be constructed wholly below the roads.

The machinery used at each of the stations is similar in design, comprising duplicate sets of double-acting differential plunger pumps driven by electric motors. The pumps are very simple in design, having hollow plungers through which the sewage flows, the area of the lower plunger being double that of the upper. Between the plungers is cast an enlargement forming a valve chamber in which a simple form of clack valve is fixed; the foot valve is situated in the bottom of the casing in which the plunger works. By this arrangement the sewage traverses the pump continuously in the same direction, and the likelihood of any deposit taking place is reduced to a minimum. The motors, which are connected to the pumps by a double reduction gearing, are 500-volt D. C. machines, compound wound, and, to give an approximately constant speed under the variations of load that the pumps have to work under, this variation being the difference of head between when the tanks are full and empty, the output of the motors ranges from 15 to 60 h.-p., the average speed being 600 r.p.m. Tests of the machinery were made by the Public Works Department, which are summarized in the accompanying table.

TESTS OF SEWAGE PUMPS.

Pump.	Duration	Sewerage per min.	Total lift.	Equivalent load.	Current.
No. 1....	14 hr.	73.33 cu. ft.	94.65 ft.	15.77 hp.	27.0 hp.
No. 2....	14½ hr.	69.89 cu. ft.	92.35 ft.	14.66 hp.	26.62 hp.

Although it was originally proposed to pump all the silt into the gravitation mains, it was found that the old sewers were so badly trapped that large quantities of sand and grit from the streets were carried to the pumps. Hence, while the pumps were effective in removing the trouble from the station, the grit scored the plungers and was deposited in the gravitation sewers, whence it had to be removed at great cost. To obviate this destruction of the plungers, interceptors have been placed in the tanks. The grit thus does not reach the pumps and is removed from the wells at night by an electric hoist; it is then placed in iron hopper carts and deposited direct into a scow which is towed at daylight to sea.

The electricity is supplied at the rate of one penny per Board of Trade unit, and the cost of pumping, although distributed over comparatively small plants operated at distances up to seven miles apart, has only been 0.84 penny per 1,000 imp. gal. lifted 100 ft.

A SAND FILLED ROAD has been constructed under the direction of the Massachusetts Highway Commission in Lynn. On each side is a rock embankment with 1:1 slopes, and the space between is filled with sand and other soil from the adjacent flats. Part of it was thrown up by dredgers using orange-peel buckets, but most of it was dragged in by a scoop attached to cables worked by a 50-h.p. engine. The cables were run through pulleys made fast to wooden towers, one on the filled bank and the other 700 ft. distant on the flats. After the sand was in place it was found that near the top of the wall it was moved by the swash of the water at high tide. This was remedied by filling in behind the top of the wall with stone chips, the chips and wall being 4 ft. thick. This movement of the sand by the tidal wash is one of the things to be expected behind loose walls.

Heating, Ventilating and Air-Cooling at the New York Stock Exchange.—IV.

The Air-Cooling System.—The plant for cooling and extracting moisture from the fresh air supply during warm summer weather is unquestionably the largest installation of its class in existence. When it is stated that the board room with its 1,200,000 cu. ft. of space and 10,879 sq. ft. of outside glass walls out of a total of 18,416 sq. ft. of exposed wall surface has, during the warmest weather, been maintained at 10° to 14° Fahr. below outside temperature with a humidity indoors averaging 55 per cent., an idea of the magnitude of the system may be gained. Moreover, some 440,000 cu. ft. of space in rooms underground are also artificially cooled; while in the case of these rooms there is not the large amount of exposed wall through which a transmission of heat from the outside air can take place, it is to be remembered that underneath them is the cellar with its steam boilers and steam-actuated machinery. Before explaining at length the make-up of the refrigerating plant by which the cooling is effected, it will be of interest to trace through briefly the calculations on which it is proportioned.

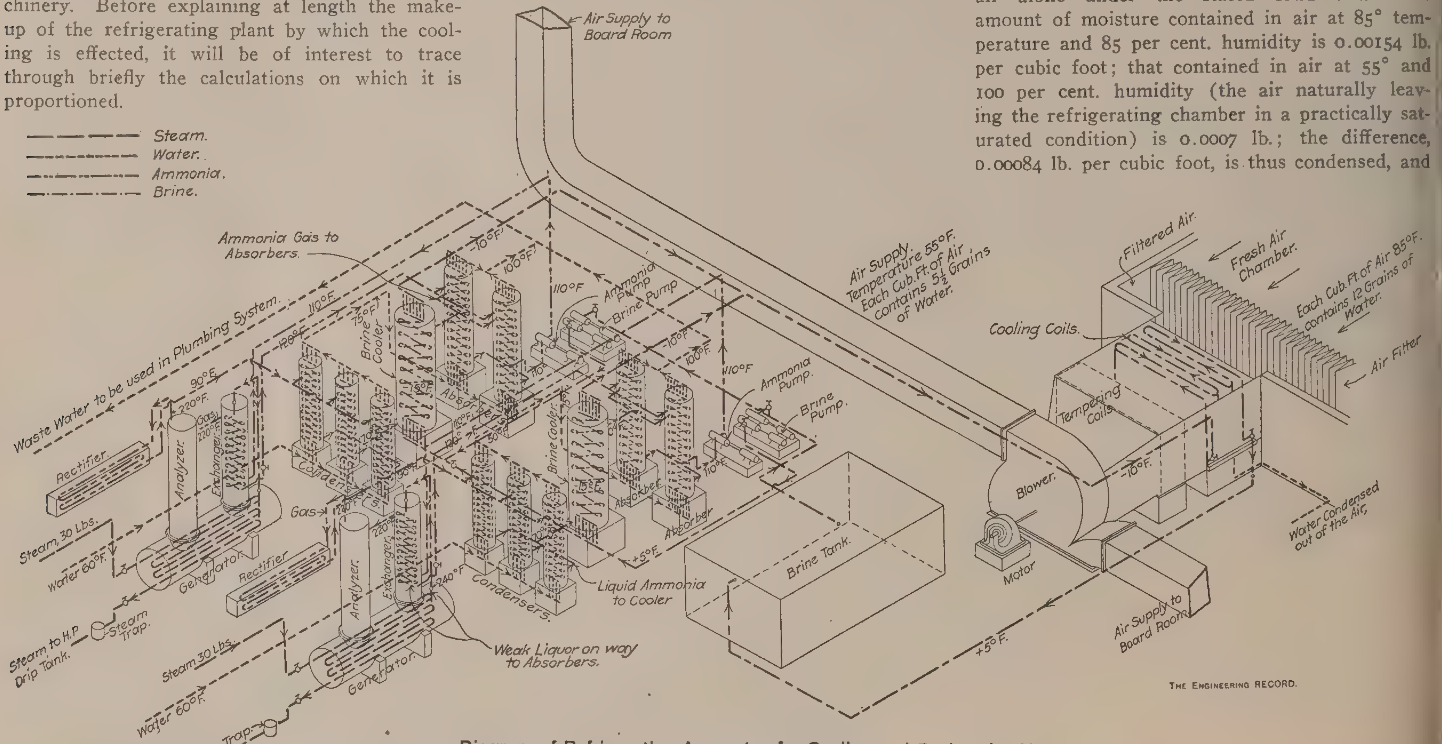


Diagram of Refrigerating Apparatus for Cooling and Drying the Air.

The summer temperature of New York City, while reaching 100° at times, is rarely higher than 85°. The average temperature, in fact, for the months of June to September, inclusive, is about 70°. The condition of discomfort, however, is the high relative humidity that very frequently accompanies periods of high temperature. It is no uncommon thing to have a humidity ranging from 93 to 97 and 98 per cent. with temperatures of 70° to 75°.

It was accordingly decided to calculate on a basis of 85° outside temperature. The records of the local United States Weather Bureau show that at this temperature the humidity is seldom greater than 85 per cent., and this factor was employed as the practicable upper limit to be considered. It was determined to maintain a temperature within the board room of 75°, and accordingly to provide for the delivery of the air into the room at 60° to 65°, and to proportion the cooling coils so as to cool the air to 55°, allowing for 5° increase in temperature during the passage of the air from the cooling coils to the room.

The problem then resolved itself into a calculation of the amount of air which introduced at 60°, and allowed to attain a temperature of 75°, would succeed in carrying off the heat supplied by transmission through the walls from the outside, as well as that given off by the occupants themselves and by such artificial illumination as is necessarily maintained at various points. Having ascertained the volume of air required, it is then necessary to calculate the refrigerating effect necessary to cool the air and also the moisture it contains.

The heat transmission through the outside walls is calculated on the basis of the 10° range assumed, that is, 85° to 75°, so that the coefficients of the transmission expressed in British thermal units per square foot per hour are about one-seventh of the corresponding coefficients employed in the calculations for the heating system, which, of course, is based on a 70° range (70° indoors and 0 outdoors). For the heat given off by the occupants, 400 B. t. u. are allowed per capita per hour and for the lights, 250 B. t. u. The latter are those comprehended in the signal system as first proposed, and while a different signal system was finally installed, the one requiring the electric lights was not abandoned until after the calculations in question were completed.

The total flow of heat thus to be provided for is tabulated herewith, and it will be noted that provision is made for the indeterminate amount of heat which may be supplied from the rays of the sun through the large areas of glass and in addition a factor, which for the want of a better designation the writer has called the factor of security, to provide for unforeseen contingencies.

Heat Units to Board Room Hourly in Warm Weather.

	B.T.U.
Window surface, 9,855 sq. ft. at 12.5 B.t.u.	122,200
Doors, 168 sq. ft. at 14.5 B.t.u.	2,440
Outside wall, 7,369 sq. ft. at 0.7 B.t.u.	5,270
Skylight, 1,024 sq. ft. at 11 B.t.u.	11,264
	142,174
Allowance for heat from the sun through windows 20 to 25%	32,826
Total transmission through walls	175,000
Animal heat from 1,000 persons at 400 B.t.u.	400,000
120 signal lamps at 250 B.t.u.	30,000
	605,000
Factor of security, 10 per cent.	61,000
Total heat from all sources	666,000

One cubic foot of air introduced into the room at 60°, or 15° below the room temperature, will take up in being warmed to the room temperature, $0.238 \times 0.075 \times 15 = 0.267$ B. t. u., 0.238 being the specific heat of air and 0.075 being the weight, in a fraction of a pound, of 1 cu. ft. of air. For the 666,000 B. t. u. to be disposed of in one hour, this means, $666{,}000 \div 0.267 = 2{,}500{,}000$ cu. ft. per hour. As one ton of refrigeration capacity per day of 24 hr. means $142.2 \times 2{,}000$ B. t. u., the one-hour equivalent is $142.2 \times 2{,}000 \div 24 = 12{,}000$ B. t. u. The required capacity of refrigerating apparatus to cool 2,500,000 cu. ft. of air per hour from 85° to 55°, or through 30° is thus

$$2{,}500{,}000 \times 0.019 \times 30 \div 12{,}000 = 119 \text{ tons},$$

the factor 0.019 being the commonly used value for the product of the specific heat and unit weight of air.

The refrigerating capacity needed for cooling the moisture contained in the air and for absorbing the latent heat given off on the condensation of that moisture is, however, 50 per cent. greater than that sufficient to effect the cooling of the air alone under the stated conditions. The amount of moisture contained in air at 85° temperature and 85 per cent. humidity is 0.00154 lb. per cubic foot; that contained in air at 55° and 100 per cent. humidity (the air naturally leaving the refrigerating chamber in a practically saturated condition) is 0.0007 lb.; the difference, 0.00084 lb. per cubic foot, is thus condensed, and for the 2,500,000 cu. ft. per hour, this represents no less than $2{,}500{,}000 \times 0.00084 = 2{,}100$ lb. of water per hour or for 8 hr., 2,000 gal. The refrigerating capacity necessary to effect separation of the moisture is as follows:

$$(2{,}100 \times 1{,}000 + 2{,}100 \times 30) \div 12{,}000 = 180 \text{ tons},$$

1,000 being taken as the number of British thermal units latent heat per pound which must necessarily be disposed of to effect condensation and 30 being the range of temperature through which the moisture is cooled, from 85° to 55°. The total amount of refrigerating capacity is thus:

For cooling the air	119 tons
For extracting the moisture	180 tons
Total	299 tons

The resulting humidity in the board room can be arrived at as follows: The 2,500,000 cu. ft. of air discharged into the room in an hour carries under the conditions assumed $2{,}500{,}000 \times 0.0007 = 1{,}750$ lb. of moisture, while the 1,000 occupants give off $1{,}000 \div 15 = 66$ lb. per hour, the per capita capacity of the individual to produce moisture being taken as 1/15 lb. per hour. This makes a total of 1,816 lb. of water per hour at a temperature of 75°. At this temperature air in the saturated condition can hold 0.00134 lb. of water per cubic foot, or for the total hourly quantity could carry through the room, 2,500,000 × 0.00134 = 3,350 lb. The actual quantity is thus apparently but 55 per cent. of the maximum amount. In brief, therefore, a 300-ton refrigerating plant is sufficient to cool air at 85° temperature and 85 per cent. humidity to 75° temperature and 55 per cent. humidity for the board room.

The cooling of the underground portion of the building is considered in a similar manner, except that the slight inflow of heat from the outside atmosphere through the confining walls and that from the mechanical plant were so indeterminate as to defy of specific estimate. There is a total of 443,300 cu. ft. of space in the three stories between the cellar and the main floor level so served. They are supplied with air by one of the fans of the mechanical ventilating plant, and this volume of space can be cooled by means of a group of cooling coils placed on the suction side of the fan in question.

The system is based on a total occupancy of 150 persons, who at the rate of 400 B. t. u. per capita generate 60,000 B. t. u. per hour. There are 800 lights distributed in the underground rooms thus cooled, and these at 250 B. t. u. give off 200,000 B. t. u. per hour, making a total supply of heat to be counteracted of 260,000 B. t. u., which increased by the factor 10 per cent., as provided for in the previous calculation, makes a grand total of 286,000 B. t. u. per hour. One cubic foot of air taking up 0.268 B. t. u. in being warmed through the assumed 15°, 286,000 ÷ 0.268 = 1,070,000 cu. ft. are required per hour. In this amount of air drawn from out of doors there are accordingly 1,070,000 × 0.00084 = 900 lb. of water to be condensed. Consequently the total refrigerating capacity needed for the underground rooms is

For cooling the air 1,070,000 x 0.019 x 30 ÷ 12,000 =	51 tons
For condensing the moisture 900 x 1,000 ÷ 12,000 =	75 tons
Total	126 tons

The resulting humidity for these rooms is, of course, to be calculated in the manner applicable to the board room, the difference being the relatively less number of persons present to give off moisture. With the required air delivery it will be found that 749 lb. of water are brought into the rooms in an hour, while 10 lb. are added in that time by the occupants themselves, making a total of 759 lb. The total amount of water which the assumed volume of air is capable of holding at the point of saturation is 1,434 lb., so that the humidity is about 53 per cent. after the air in the rooms has been completely changed.

The refrigerating plant is, however, also required to cool water for drinking and for cooling cold storage boxes in connection with the kitchen and dining-rooms maintained in the upper part of the building. The former is based on a demand for 400 gal., or 3360 lb., of water per hour, cooled through 45°, thereby requiring 151,200 B. t. u. per hour, which at 12,000 B. t. u. per hour (the equivalent of the hourly rate of 1 ton of refrigerating effect over 24 hr.), makes a total of 12.6 tons for the drinking water. A 150-ton machine was accordingly specified for cooling the air supply to the underground portion of the stock exchange and also for cooling the drinking water and for cooling the cold-storage boxes, leaving the remaining 11.4 tons to be available for the last mentioned service. Altogether, therefore, three refrigerating machines, each of 150 tons' capacity, were decided on, for combined use with both the board room and the underground rooms. It may be added that the apparatus adopted on the basis of the foregoing calculations has proved fully capable of meeting the maximum demand made upon it.

The ammonia absorption class of machine was adopted, and the machines and incidental equipment were installed by the Carbondale Machine Co. In general characteristics the refrigerating plant is a usual one in its make-up, the noteworthy feature in this connection being, as explained, the successful application of a refrigerating plant of 450 tons' capacity almost altogether for cooling air for ventilation.

Each machine includes a horizontal generator, 52 in. in inside diameter and 18 ft. long, containing 1,300 sq. ft. in twelve coils of 2-in. extra-heavy steam pipe together with an analyzer and an exchanger superposed on it, the analyzer being 39 in. in inside diameter and 12 ft. high, and containing sixteen trays, and the exchanger being 36 in. in inside diameter and 10 ft. 6 in. high and containing 900 sq. ft. of extra-heavy pipe coil surface. The overhead rectifier for each machine consists of three coils of 3-in. extra-heavy pipe encased in an open top tank; the two condensers are each 44 in. in inside diameter and 10 ft. high, containing 1,350 sq. ft. of surface in extra-heavy pipe coils; the one brine cooler in each case is 52 in. in inside diameter and 10 ft. 10 in. high, containing 1,800 sq. ft. pipe coil surface; and the two absorbers are each 44 in. in inside diameter and 10 ft. 10 in. high, containing 1,350 sq. ft. of pipe coil surface.

The machinery is all located at one end of the mechanical plant in the cellar and is extended through both the cellar and sub-basement No. 2. There are three 16x7x16-in. direct-acting single steam-actuated ammonia pumps, one for each refrigerating machine, and two main duplex steam-actuated brine circulating pumps, of the Blake make, 14x12x12-in. in size, and one auxiliary brine pump, 10x7x12 in. in size. The pressure of water from the city mains is sufficient to force itself through the apparatus and thence into the sewer, which is considerably above the cellar-floor level. However, after passage in succession through the condensers and absorbers, it is delivered into a 1,200-gal. closed waste or storage tank at one end of the refrigerating machine room, built of ¼-in. steel plate, and from this tank it is ordinarily taken by a 16x12x10-in. steam pump and lifted, under the control of a Ford governor, to a tank in the attic for flushing purposes in lavatories and the like throughout the building. Any excess of water over what is taken by this house or waste-water pump, is sent to the sewer.

The capacity of each refrigerating machine, as defined in the specifications, is as follows: It must cool 250 gal. of chloride of calcium brine at a specific gravity of 1.25 from a temperature of 5° above zero to a temperature of 10° below zero Fahr. in every minute. The hourly consumption of steam in the generators is required not to exceed 40 lb. for each 1,500 gal. of brine cooled 1° Fahr., and the hourly water consumption for the same cooling effect, the temperature of the condensing water being assumed at 60°, is not to exceed 105 gal. The refrigerating generators are designed for either live or exhaust steam, and as a matter of fact it has been found that the exhaust from the electric lighting and pumping plant at 2 lb. pressure proved to be sufficient at all times to operate the ammonia generators without expense on the score of live steam.

The brine circulating mains include 8-in. suction lines from the brine storage tank to the pumps and same size connections to inlets on the brine coolers, a 6-in. main from the coolers to the corresponding bunker coils and a 6-in. return to the brine tank. The main discharge from the coolers to the bunker coils is provided with a 2½-in. tee, where the supply is taken for the refrigerator boxes, this connection being carried to the auxiliary pump, which is employed for delivering it to the top floor of the building where these boxes are located. A 2½-in. return is brought to the brine tank. The brine tank is built of ¼-in. steel, and is 38 ft. long, 6 ft. 8 in. wide and 9 ft. 4 in. high. When the air-cooling plant is not in operation, the refrigerating plant is operated a few hours a day to cool down the brine in the brine tank, and the auxiliary brine pump is connected to draw from this during the whole of the day.

There are two coil bunkers, or stacks of coils, for cooling the air supply, made up of 1¼-in. galvanized iron pipe. The bunker for the lower floors contain roughly 10,000 lin. ft. of pipe, which is equivalent to about 4,350 sq. ft. of surface, and the group for the board room, about 20,000 lin. ft., or 8,700 sq. ft. The 300 tons capacity needed for the board room, for example, are equivalent to the hourly transfer of 3,600,000 B. t. u., which, for the 8,700 sq. ft. of surface, means a transfer of 415 B. t. u. per square foot per hour. As the cooling coils are made to pass brine only long enough to get the rooms at the desired temperatures during the working day, the frost that collects on the outside of the coils during operation is melted after the brine circulation is stopped, and a 16-oz. copper drip pan is furnished under each stack with waste connection for this purpose.

The drinking water system is supplied ordinarily from the return brine from the cold-storage boxes, the brine being circulated in 1¼-in. coils in a galvanized iron cooling tank. The system is designed to cool and filter 400 gal. of water from 80° to 35° per hour. A Loomis-Manning filter of 15 gal. per minute capacity is provided, and a 6x4x6-in. pump serves to deliver the water to the different faucets through galvanized iron mains. There are two risers to the top of the building, one fitted with 10 and the other with 12 faucets, and three risers to the board room with two faucets to each riser. There are circulation pipes returning to the cellar.

The accompanying isometric perspective diagram has been included among the illustrations to show at a glance the essentials of the air cooling system, and, on the ammonia, brine and water systems, the temperatures under normal conditions and at different stages of the process are noted. Two condensers were actually installed for each generator and not three, as shown in the diagram.

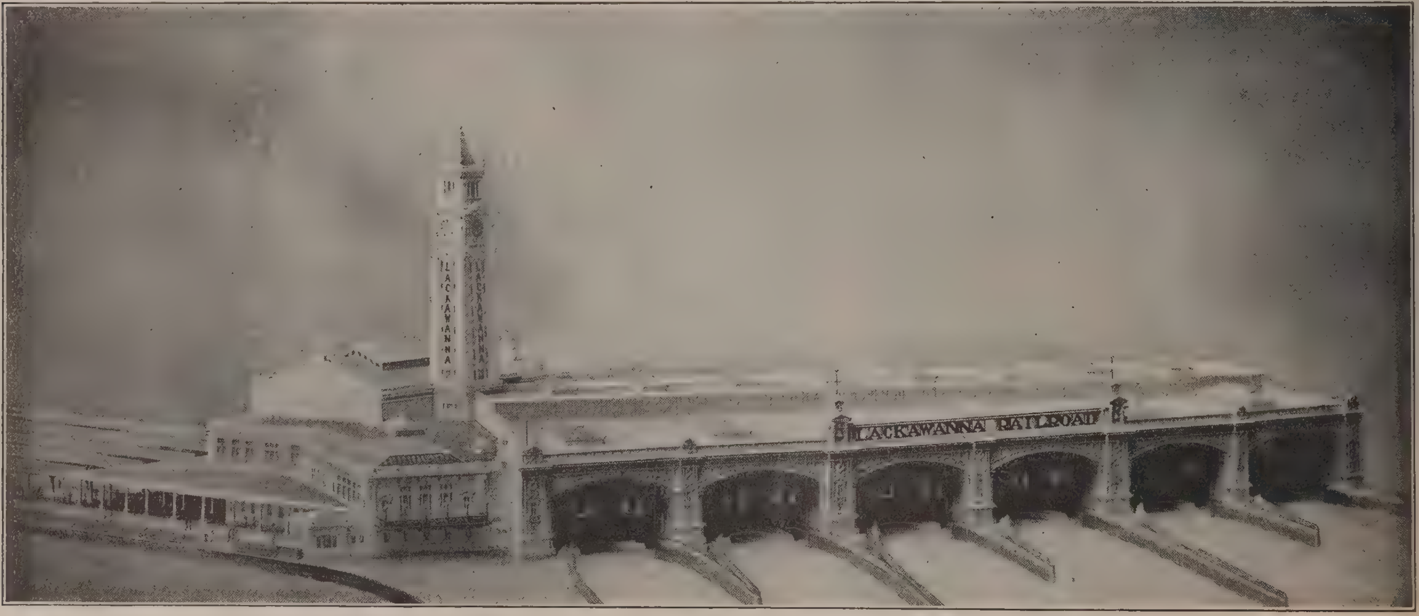
THE FAILURE OF A BRIDGE in Indianapolis while the construction car of a street railway was passing over it was discussed by the Indiana Supreme Court in City of Indianapolis v. Cauley, 73 N. E. Rep. 691. The bridge had previously been condemned by engineers representing the city and the railway company, and had been repaired under the inspection of employes of the board of public works. The failure occurred early in the afternoon of the day on which the bridge was again opened for traffic. The court's comments on the action of the board read as follows: "In the selection of inspectors, the diligence required of the board of works, to be accounted reasonable, must be measured by the known importance and difficulty of the work to be performed. . . . When it comes to the selection of a skilled man to inquire into and determine the true condition of a bridge of great magnitude, more than 400 ft. in length, and of questionable safety, over which heavily loaded cars, vehicles of every description, and thousands of people pass every day, the law is not satisfied with the finding of a professional civil engineer of good repute and creditable employment. Before it can be said that the board of works was justified in the appointments it made, it must appear that it not only believed the appointees were competent, but it must be able to show that it had good grounds for entertaining such belief."

The New Hoboken Terminal of the Lackawanna R. R.

The new terminal station and ferry house of the Delaware, Lackawanna & Western R. R. at Hoboken, N. J., the construction of which has just been started, is a part of the extensive improvements near the eastern terminus of that road which have been outlined and portions of which have been described in detail in this journal. The railroad company operates ferry lines between its terminal and Barclay and Christopher Streets, New York City, and between Fourteenth Street, Hoboken, about a mile north of the terminal, and Twenty-third Street, New York. The company's boats now carry about 100,000 ferry passengers daily. Nearly one-third of this traffic is between New York City and suburban towns in New Jersey reached by train, with considerable through traffic. The remainder of the passengers either pass from the ferry house to the terminal station of a system of local and interurban electric roads that adjoins the railroad terminus or reside in nearby parts of Hoboken.

The present station building and ferry house is a timber structure that was built in 1880, and has become entirely inadequate to comfortably accommodate the traffic. It consists of an eight-track steel-frame train shed, a one-story station building and ferry house and five ferry slips, with entrances to the boats from the train shed and from the street. The new terminal will have a river frontage of 600 ft. and a width of 400 ft. to the outer ends of the ferry racks. In order to increase the width of the street adjoining it, and provide room for ferry slips, it will be built entirely outside the line of solid fill, with its river front 150 ft. farther off-shore than the river front of the present structure.

The building is to be a steel-frame structure with reinforced cinder concrete walls and floor slabs and a slag roof, 5,000 tons of structural steel being required to complete it. It is designed to be practically fireproof, as the only wood used in its construction will be in the doors and the floors of a few office rooms. The greater part of the site is covered by 20 ft. or more of water at mean high tide, with about 60 ft. of silt beneath the water, and the building will be erected entirely on a foundation of piles driven through the silt to hard pan.



The New Terminal Station and Ferry House of the Delaware, Lackawanna & Western R. R. at Hoboken, N. J.

The general design of the new structure is shown in the accompanying illustration. The ferry house is long and narrow, built parallel to the river, with the station building at one end. The existing ferry house is one story in height, and the old ferry boats have entrances only at their lower decks. The new ferry house will be two stories high, and as the new boats which have recently been put in commission have entrances at both deck levels, passengers may use either floor of the ferry house in embarking and disembarking. The second floor entrances to the boats connect with a 72x450-ft. concourse ending in the station building proper and will be more used by passengers than will the lower floor, where vehicles are crossing. A similar concourse connects with the first floor entrances, however, and also ends in the station building, with exits directly to the street from the boats for passengers and teams.

The concourse on the second floor is so arranged at the station end that suburban passengers may proceed directly from the boats down a flight of stairs 40 ft. wide to their trains. An entrance to the waiting room is also provided, while Hoboken passengers have a separate exit and the station of the electric roads may be connected with the end of this concourse by an overhead bridge. Similar exit arrangements are made on the ground floor. East-bound passengers desiring to enter the boats may pass through the first-floor concourse directly from the trains, waiting rooms or the street to the lower deck of the boats. Those desiring to reach the second deck may ascend to the second-floor concourse on an inclined plane of slight grade, or by elevators and stairways.

The main waiting-room is 100 ft. square and 54 ft. high, with a large amount of window space on all sides, and skylights in the roof. Women's rooms, smoking rooms, a lunch room and the usual conveniences are to be placed around three sides of it, while the fourth side is given over to entrances to the train sheds. A large dining-room is to be built on the second floor at one corner of the building, and a wide balcony extending out over the water will be connected with it and used as an open-air restaurant in summer.

The floors throughout the terminal will be constructed of permanent fireproof materials except those in the few small offices mentioned. The floors of the concourse will be asphalt, and those of the team gangways brick. The waiting room and dining room will have mosaic tile floors. Careful attention has been given in the design to supply a large amount of light to every part of the building, and practically all of the glazing will be of wire glass, most of the windows having metal sashes. A complete fire system with standpipes will be installed, and the terminal will be lighted and heated from a separate power station, built as a part of the improvements on an adjoining site. The indirect system of radiation, with blowers and exhauster, will be used in heating a part of the building, the same apparatus being used for ventilation. The remainder of the building will be heated by the direct system.

The 225-ft. clock tower, which appears so strikingly in the illustration, is added purely for architectural effect, and will not contain any space that will be used for offices or other purposes. It is a copper shell on a steel frame, and has been designed to be as light as is consistent with safety and appearance, in order to decrease the load on the foundations.

The facilities for handling trains will consist of 16 tracks, having a combined capacity of 180 cars. A 16-ft. concrete platform extends the length of the trains between each pair of tracks. The type of the train shed will be a series of umbrella roof platform coverings, built in separate sections, and supported on single rows of columns.

Building the entire structure outside of the line of permanent fill and over a site presenting the conditions met with in this case will necessitate a very large number of piles to provide a firm foundation. Single sticks of long leaf yellow pine are to be driven, and splicing will not be permitted, although a large percentage of the piles will be upward of 80 ft. in length, to reach the hard pan underlying the silt. They will be driven in clusters of from 15 to 35, and will be loaded with from 10 to 13 tons to the pile, 420 tons being the maximum load on any pile cluster. They will be sawed off at mean low tide, and a timber grillage extending up to 6 in. below mean tide placed over them. Footings of concrete will be laid directly on the grillages, and the posts and columns of the building frame anchored to them.

Timber piles were adopted after considerable investigation of the condition of old pile foundations placed under similar structures in the vicinity. Piles driven 20 years ago near the proposed site have recently been removed and show practically no signs of deterioration, and no evidences whatever of the workings of the teredo, the latter having been kept out by the presence of sewage in the water.

The existing terminal yards are also to be completely rearranged, and the facilities for handling passenger trains greatly improved. A new immigrant station and ferry house, entirely separate from the terminal station, is being built as a part of the improvements. An independent boat will be operated between this station and the government immigration station at Ellis Island to handle the large number of immigrants who are carried to the West over the lines of the company. This arrangement not only permits of more rapid and direct transportation of immigrants, but also avoids mingling them with the regular ferry passengers.

The construction of the new work had to be planned with as great care as is ordinarily used in the design of a structure, due to the congested conditions at its site and to the fact that the heavy suburban traffic must be maintained without interruption. The work has been divided into six sections, beginning at the station building end, and the existing structures will be torn down and the new one built in one section at a time. The existing slips are so constantly in use that before one of them can be removed a new one has to be built to take its place. Provision must also be made for the direct ingress and egress of train passengers to all the slips, as new slips are put in service and construction is progressing between the new and existing slips. The unusually large number of long piles that must be driven adds further complications to the building operations, since all driving will have to be done from scows in the river and out of the way of the regular boats.

The first section is at the station-building end and includes the first slip and a part of the new structure. As it is largely beyond the limits of the present building and outside the slips now in use, it can be completed without material interference with traffic. The other sections follow consecutively, and work will be carried on in them in the order in which they come.

A new steel-frame ferry house is being built at the site of the Twenty-third Street ferry house of the company's lines, and will be completed some time this year. Boats will then be operated between the Hoboken terminal and Twenty-third Street, and the existing lines will all be kept in operation, the old boats being replaced by new and larger ones as rapidly as they are put out of commission.

The Hoboken station building and ferry house have been designed by Mr. Kenneth Murchison, of New York. The foundation plans have all been worked out in the department of buildings and docks of the railroad company, Mr. J. E. Snell, superintendent. The removal of existing structures, temporary construction and the construction of the foundations will be done by the railroad company's forces under the general direction of Mr. L. Bush, chief engineer, and the direct supervision of Mr. Snell. The contract for the superstructure and erection of the steelwork of the terminal building and ferry house has been awarded to Snare & Triest, New York. The steelwork of the superstructure will be fabricated by the Fort Pitt Bridge Co.

Double-Acting Centrifugal Pumps, which work with the shaft running in either direction, are not novel, but a new type which has been designed by the Morris Machine Works is stated to have unusual efficiency for its class, rivaling the single-acting pumps. One feature claimed for it is the small amount of power required when the discharge is closed; this enables the water to be kept under pressure all the time, even when it is not being discharged, and makes it unnecessary to use the overflow or storage tanks generally employed with centrifugal pumps in pulp mills and similar works.

Variable Speed Motors for Driving Machine Tools.

At the recent convention of the National Machine Tool Builders' Association, there was an animated discussion of the application of individual variable-speed motors for driving machine tools. This was under three general headings. First, the advantages of the motor drive and the greater power necessary in the belt drive for such tools; second, the relative cost of power for belt-driven and motor-driven shops; third, the standardization of motor drives. Mr. G. Herbert Condict, vice-president of the Electro-Dynamic Co., of Bayonne, N. J., was invited to take part in this discussion and made the following comments:

In the first place as to the advantage of the motor-driven tool over the belt-driven, it was pointed out that in the case of equipping a new shop a saving can be made in the initial cost of the power plant, owing to the fact that there will be less loss in the transmission of the power from the engine shaft to the shaft of the tool, and therefore a smaller power plant will be required. With the belt drive it had been practically demonstrated that the average loss in the shafting and belting amounted to at least 50 per cent. of the total power developed by the engine. This is owing to the fact that when a belt is laced it is made as tight as possible in order to provide for stretching, and this results in loss of power in the friction in the bearings as well as in the running of the belt itself. After the belts have run for some time they become loose and there is a loss of power in the slipping. In the case of the line shafting itself, no matter how carefully the line may be put up in the first place, there will shortly be a certain amount of distortion, especially in a long and heavy shaft, which in time will cause a great loss in the shafting bearings even if they are well lubricated.

In the electrical transmission, assuming that the shop is to be operated at, say, 75 per cent. of the generator capacity, so that a good efficiency can be obtained from the generator itself, the loss between the engine shaft and the line will be about 6 per cent., the line loss 2 per cent., and an average loss in the motor itself, if of high efficiency, of 17 per cent., a loss of 5 per cent. between the motor shaft and the shaft of the tool itself, where a single pair of gears or a chain drive is used, or a total loss between the engine shaft and the tool shaft of about 28 per cent. Attention was called to the fact that the loss in the shafting and belting is practically a constant loss no matter whether the shop is operated at its full capacity or not, where the loss in the case of the electrical transmission varies practically with the power used.

Instances were given of a plant which has been entirely equipped with individual motor drive, in which only one-half of the power capacity had been installed that had been calculated as necessary in the case the shop had been designed for belt drive. This power plant had been operated on an average of only one-half of its capacity, thus showing that in this particular case only 25 per cent. of the power was required for running the shop with electrical transmission that had been estimated on for belt transmission. Another case was given in which it was desired to operate only a few tools in a shop, for which about 25 h.p. would be requred, and a spare engine of about 35 h.p. capacity was started up to do the work. It was found that this engine would not turn over the shafting, and upon a careful investigation of the entire plant it was discovered that over 50 per cent. of the power was consumed in the shafting alone. One of the members of the Association had stated that he knew of a case of power transmission which had been carefully tested, and in which it was found that 83 per cent. of the power produced had been consumed in shafting and belting. It is, therefore, assumed that the average loss in belt-driven shops of 50 per cent. of the power is not excessive, and that a large saving in the initial cost of the power plant would result if the electrical drive were adopted in place of the belt drive. As to the relative cost of the equipment of tools with individual motors and of their equipment with shafting and belting, it is impossible to arrive at any exact figures, but provided that the two-wire system should be adopted (as in the case of the Inter-Pole motor) it is believed that the cost of the electrical transmission would be much less than that of the belt and shafting transmission.

As to the difference in cost of maintenance of the motor drive and shaft-belt drive there is no question, Mr. Condict said, that the former will show a greater saving over the latter, as in the case of the electrical drive the cost of maintenance is comparatively small, assuming that the electrical apparatus is made according to the most advanced designs. This is particularly the case in electrical machines using ball bearings, owing to the fact that a guarantee of ten years can be obtained on these bearings from the manufacturer.

Statement was made by one of the members of the Association that he had been unable to secure from any of the electrical manufacturers a variable-speed motor which would operate on a 500-volt circuit. Mr. Condict stated that the Inter-Pole motor would operate on a 500-volt circuit as well as on a 110-volt circuit with high efficiency and absolutely sparkless, even at a speed ratio of 4 to 1.

Attention was called to the celerity with which speeds of the tool can be changed, and also to the fact that very much greater variations of speed can be secured so that the tool can be run at the most advantageous rate for any given work. There is also less opportunity for accident to men and equipment, owing to the fact that there are no belts to throw on and off. In this connection the saving in time was referred to; in the case of the electrical change it is only necessary to turn a handwheel or lever instead of throwing a belt from one pulley to another. Assuming that the generating plant furnishing the power is built on up-to-date methods so that a spare unit is available, there is practically no liability of a shutdown on account of a hot bearing or breakage in any part of the equipment.

Reference was made to a case in which a department of a machine shop was being examined, where the bulk of the tools were driven from a line of shafting but one lathe was equipped with a variable-speed motor. A hot bearing occurred on the line shaft and shut down all tools run by the shaft, and for 20 minutes 23 machines were idle, while the machinist on the motor-driven tool continued his work. As these shut-downs are liable to occur in the best regulated shop from various defects and troubles of shafting and belts, this item of saving is quite an important one.

Attention was called to the fact that in the conventions held by the electric power and lighting interest, no reference is now made to the belt driving of electric generators, as no designer of a modern plant would consider anything but a direct-connected unit. The inference drawn was that in all probability the equipment of the shop by shafting and belting will not be considered by future conventions of the Machine Tool Builders' Association, as there seems to be a desire on the part of both the machine shop men and the builders of machine tools to equip all tools, no matter of what capacity, with the individual motor drive. Incidentally, reference was made to the absence of dirt and non-interference of the lighting, which are features of the shop equipped with the motor drive.

A Comparison of the Theoretical With the Actual Fuel Consumption in Cement Burning.

Paper read before the Association of American Portland Cement Manufacturers by Henry S. Spackman.

In order to compare comprehensively and logically the theoretical with the actual fuel required in practice to calcine Portland cement in the rotary kiln, it is necessary to have a clear conception of the physical and chemical changes taking place in the raw material as it passes through the kiln, and to follow in the same manner the fuel in its opposite progress, from its entrance to the hood, through combustion and all its changes, until the gases are discharged to the stack.

We have little exact knowledge of what takes place in the kiln, depending largely on the eye for information we now have, which is often contradictory; doubtless due to the fact that in no two works will be found identically the same detail conditions, although the general phases may appear the same. The chemical and physical laws governing the process are, however, well understood, and enable us to state definitely what must occur, but not exactly how and when.

Avoiding a discussion of the various theories advanced by different authorities to account for each of the numerous reactions or the consideration in detail of the disputed problems involved, we may define Portland cement as "a finely ground silicate formed by the calcining to the point of vitrification of a properly proportioned and intimately blended mass of clayey and calcareous materials," and state the chemical reaction during the process of calcination broadly as follows:

On entering the kiln, the water mechanically held in mix is driven off. The now dry material gradually rises in temperature to the point at which the clayey matter becomes anhydrous, any silica present in the form of quartz becoming amorphorus. The carbonate of lime is at the same time decomposed, giving off its carbon dioxide, the lime probably replacing at a little higher temperature the chemically combined water originally in the clay. Subsequent to this, with a still higher temperature, the lime begins to combine with the fine grained and easily attacked free silica. If at this point the calcination was stopped, the material would resemble Roman cement or pozzuolana cement in its characteristics.

As the temperature in the kiln is raised still higher the magma formed by the fluxing constituents of the clay attacks both the silica and the lime. Silicates and aluminates are now probably formed, a considerable amount of uncombined lime being also present. With a still higher temperature vitrification takes place and within a comparatively short temperature interval tricalcic-silicate is formed. This final reaction is usually considered exothermic, but partially completed investigations in our laboratory lead me to believe that very little heat is given off in the formation of these higher silicates and that possibly the reaction is endothermic. We can best picture this progress to ourselves by supposing the product of the fusion of the more easily melted fluxes attacking the silica, which in turn dissolves more and more lime, the magma as in all calcereous bodies fusing with great rapidity.

In order to calculate the heat required to turn the raw material into clinker it is necessary to separate the process into its several stages, and I have adopted the following natural division, suggested by the work to be performed. In the statement of the formulæ, H represents heat, W weight, T final temperature, t initial temperature, S specific heat, Tf temperature of the flue gas.

First—Heat required to raise the solid matter in the raw material to 100° C.; $H = W (T - t) S$.

Second—Heat required to raise the free water mechanically present in the mix to 100° C.; $H = W (T - t) S$.

Third—Heat required to evaporate the water from and at 100° C. into steam at atmospheric pressure; $H = W \times 536.5$ calories.

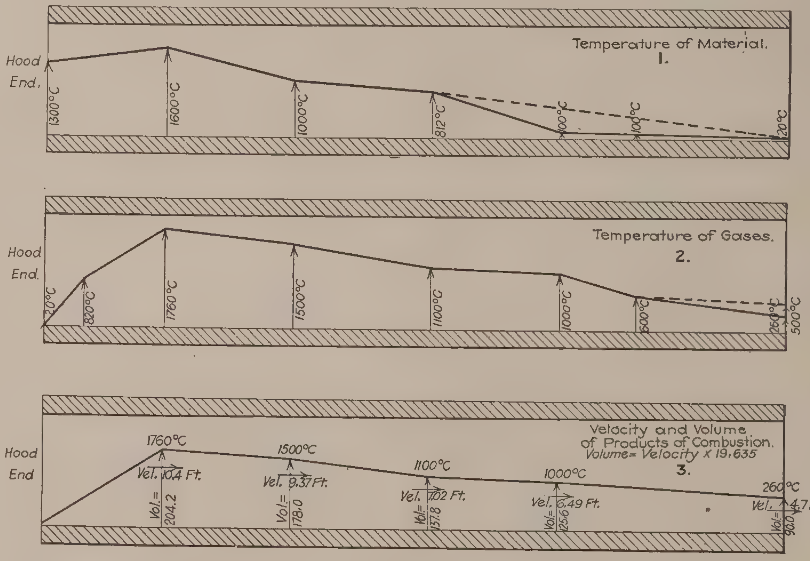
Fourth—Heat required to superheat the steam from the water so evaporated to the temperature of the flue gases; $H = W (T - t) S$.

Fifth—Heat required to raise the now dry material to the temperature at which magnesium carbonate parts freely with its carbon dixoide, which is assumed in the calculations of this paper to be 500° C.; $H = W (T - t) S$.

Sixth—Heat required to disassociate the carbon dioxide from the magnesium carbonate; $H = W \times 213.1$ calories.

Seventh—Heat required to raise the carbon dioxide driven off from the magnesium carbonate to the temperature of the flue gases. This will be a minus item to be deducted from the total heat required if the temperature of the flue gases is below that at which the carbon dioxide is driven off from the magnesia carbonate; $H = W (Tf - t) S$.

Eighth—Heating of the raw material to 812° C., the temperature at which the tension of the carbon dioxide in the carbonate of lime equals atmospheric pressure and above which it is driven off freely; $H = W (T - t) S$.



Diagrams of the Working Conditions in a Cement Kiln.

Ninth—Heat required to disassociate the carbon dioxide from the carbonate of lime; $H = W \times 437.4$ calories.

Tenth—Heat required to raise the carbon dioxide driven off from the lime to a temperature of the flue gases. This will be a minus item to be deducted from the total heat requirement if the temperature of the flue gases is below 812° C.; $H = W (Tf - t) S$.

Eleventh—Heat required to raise the temperature of the mix to approximately 1,600° C., and at which temperature it is assumed clinkering takes place with the average material; $H = W (T - t) S$.

To the total amount of heat so found might be added the heat required to volatilize the alkalies and oxidize the sulphur liberated, but this was considered such a small quantity in comparison with the other figures that it has been disregarded.

Calculations to determine the heat required in burning must be based on the specific heats of the materials. Those used are probably too low, as they are the specific heats of the materials at 100° C., and specific heats undoubtedly increase with higher temperatures.

Thurston states that the specific heats increase slowly with the rise of temperature, approximately doubling for coke with an increase of 900° C., becoming increased four times in the same range with the limestone, and increasing 50 per cent. with lime. At 2,000° C. coke has a specific heat of 0.5 and slag 0.4.

The commonly accepted specific heats of these materials at 100° C. are: Coke, 0.1571; limestone, 0.1666; lime, 0.217; clay, 0.2.

Turning now to the consideration of the fuel and its combustion, we may take the conditions in column 3 of table I as typical of the best manufacturing practice. On examination we find that with a production of 165 barrels of cement per day of 24 hours, we have 0.72 lb. of clinker produced per second, requiring for its production 1.94 lb. of slurry, for the calcination of which 0.213 lb. of coal per second is required, this amount of coal requiring for complete combustion 2.1 lb. of air (27.9 cu. ft.).

Considering the introduction to the kiln of only the theoretical amount of air required to burn this amount of fuel, we find approximately the following conditions:

The coal reduced to a fine powder is forced into the kiln, mixed with about one-fourth of the amount of air necessary for its combustion, the remaining air being supplied through openings in and around the hood. On entering the kiln, the mixture of powdered coal and air, including that entering apart from the coal, is raised to a temperature of about 820° C.

At this temperature the volume of air previous to combustion would be increased from 27.9 cu. ft. to 84.4 cu. ft., which gives a minimum velocity of 4½ ft. per second, the internal diameter of the kiln being 5 ft.

On ignition, which is assumed to take place at 820° C., if the combustion was instantaneous and none of the heat lost, the calculated temperature of the flame would be 2,870° C., or 5,200° F. Theoretical flame temperatures, however, are not obtainable in practice, and it is not probable that the temperature in the kiln exceeds 1,760° C., or 3,200° F., the difference being explainable by the increase in specific heat of the gases with high temperatures and the absorption of heat by the walls of the kiln, incoming air and material in process of calcination. At 1,760° C. the products of combustion have a volume of 204.2 cu. ft., and a minimum velocity of 10.4 ft. per second. As the heat in the gases is used to raise the temperature of the material and in driving off the carbon dioxide, their temperature is reduced to 812° C., and the volume is 187 cu. ft., corresponding to a minimum velocity of 9.37 ft. per second. The increase in volume of the gases due to the addition of the carbon dioxide driven off from the raw material is very small, the amount measuring at 812° C. only 5.98 cu. ft. The temperature of the gases is still further reduced as more heat is absorbed in the work of driving off the water and raising the temperature of the materials. The gases just prior to their exit from the stack have a temperature of 260° C., while the products of combustion combined with the steam developed in drying the slurry have a volume of 90 cu. ft., with a minimum velocity of 4.7 ft. per second.

These changes in temperature and velocity are more clearly expressed by the accompanying diagrams, which, however, are largely hypothetical and must not be taken as exact statements of conditions. Diagram 1 shows the heat curve of the raw material, the ordinates of the curve representing the temperature, the dotted line showing temperatures for the dry process, the solid line for the wet.

The cement mixture entering the kiln at a temperature of 20° C. is heated by contact with hot gases as it advances through the kiln. Little or no drying takes place by evaporation until the boiling point of water is reached, the gases having been saturated to their full carrying capacity by previous contact with the steam and wet materials; the increase in temperature is practically uniform until 100° C. is reached, at which temperature the material remains until the major portion of the water is driven off, the heat absorbed from the gases being utilized in generating steam. The lack of convection in the mix as it becomes more solid is partially compensated for by the agitating of the material due to the rotation of the kiln. After drying, the rise in temperature is rapid until 812° C. is reached, when another flattening of the curve takes place owing to the utilization of the heat absorbed in driving off the carbon dioxide, instead of in raising the temperature of the material.

TABLE I.—ACTUAL AND THEORETICAL FUEL REQUIREMENTS FOR BURNING 100 LB. CEMENT.

Plant	1	2	3	4	5	6	7
Process	Dry	Dry.	Wet.	Wet.	Wet.	Wet.	Wet.
Size of kiln	6'x60'	6'6"x72'	6'6"x98'	6'6"x98'	6'6"x98'	6'x70'	6'x60'
Cement, bbls. per 24 hours	200	239	165	150	240	125	96
Coal per bbl.	92	103	113	114	152	147	180
Analysis.							
Silica	14.58	12.56	7.70	6.84	8.00	6.46	3.92
Alumina	4.20	5.8	3.57	2.22	3.34	1.82	1.20
Iron	2.09	1.2	.31	.83	.49	1.82	.60
Calcium carbonate	74.80	68.91	44.05	38.22	40.93	30.62	20.40
Magnesium carbonate	2.32	4.90	1.16	.70	1.61	1.00	.30
Sulphuric Anhydride	.50	.23	.09	.09	.07	.81	.06
Water of admixture	..	5.00	42.00	50.00	45.00	57.00	70.00
Loss on ignition	2.00	2.26	3.96	3.46	1.38	2.54	3.39
Material to produce 100 lb.	157.70	164.60	270.90	315.26	284.00	386.10	577.80
Loss on calcination	57.70	64.60	170.90	215.26	184.00	286.10	477.80
Coal per 100 lb. clinker	24.20	27.10	29.61	30.00	40.00	38.70	47.30
Coal per 100 lb. clinker	23.90	22.70	27.70	28.10	38.80	34.00	51.50
Actual Calories	179,400	170,730	208,226	211,400	291,933	255,015	387,860
Theoretical Calories	93,171	95,113	169,302	200,103	175,888	244,197	372,881
Efficiency per cent.	51.80	55.70	81.30	94.60	60.20	95.70	96.10
Heat loss	86,229	75,617	38,924	10,297	116,045	10,818	14,979

At a temperature of 1,000° C. the decomposition of the carbonate of lime is practically complete, and the temperature of the material increases rapidly until the clinkering point is reached. From this point the temperature gradually decreases, the clinker giving off part of its heat, which is utilized in raising the temperature of the air required for combustion.

With the dry process, as indicated by the dotted lines, the increase in heat is probably constant until the temperature of 812° C. is reached, from which point the temperature curves by the dry and wet processes are identical.

Diagram No. 2 shows temperature of the gases at different points in the kilns.

The air and coal entering the kiln rises rapidly in temperature on combustion, the maximum being reached at about 16 ft. from the hood; after this there is a gradual decrease due to the absorption from the gases of the heat used to raise the temperature of the mix to the clinkering point and in driving off the carbon dioxide. The fall in temperature is comparatively uniform until the point is reached at which limestone begins to part with its carbon dioxide. From this point until the wet material comes in contact with the gases, their temperature suffers but little diminution, as the only work required of them is to raise the temperature of the material. On coming in contact with the wet material they are rapidly cooled, being reduced in the last 30 ft. of the kiln 740° C.

With the dry process, as indicated by the dotted lines on the diagram, the rate of cooling will be practically uniform, the only flattening in the curve occurring just before the carbon dioxide begins to be driven off.

The temperatures of the gases shown in the diagram are calculated on the basis of the least sensible heat the gases must have in order to contain the requisite number of calories to do the work required of them beyond the point for which the temperature is given, plus the heat carried out at the stack.

Diagram 3 shows the volume of the gases and their velocity through the kiln per second at the points indicated; this was figured by dividing the number of cubic feet of the gas at the various temperatures by the area of the interior of the kiln. The actual velocity is probably higher, as the diameter of the kiln will be reduced by material adhering to the fire brick lining, the velocity of the gases being proportionately increased without any decrease in diameter. It is also probable that the draft created by the stack accelerates the velocity of these gases. The time required for the passage of the gases through the kiln is approximately as follows:

TABLE II.—COMPARATIVE TABLE OF THEORETICAL HEAT REQUIREMENTS FOR EACH STEP IN THE BURNING.

	Formula.	Coefficient.	Pound calories.	Pound calories.	Pound calories	Pound calories.	Pound calories.	Pound calories.	Pound calories.
First	H=W(T—t)S	S=.22	2775.	2752.	2765.00	2774.28	2714.27	2923.30	3051.80
Second	H=W(T—t)S	S=.22	....	658.04	9104.00	12610.40	10094.40	17600.00	32352.00
Third	H=536.5W		....	4415.40	61043.70	84568.50	67706.00	118030.00	216960.00
Fourth	H=W(T—t)S	S=.4805	....	396.68	8748.90	12118.60	9700.71	16913.60	31090.20
Fifth	H=W(T—t)S	S=.22	13877.60	13760.56	13824.80	13870.00	13571.30	14616.80	15259.00
Sixth	H=213.1W		780.00	1715.45	669.10	468.82	961.08	822.60	368.60
Seventh	H=W(Tf—t)S	S=.24	....	....	—94.40	—66.24	—135.36	—116.30	—51.84
Eighth	H=W(T—t)S	S=.22	10693.40	10444.26	10665.00	10740.78	10424.35	11262.40	11840.40
Ninth	H=437.4W		51595.70	49609.90	52194.90	52706.70	50200.40	51709.40	51556.00
Tenth	H=W(Tf—t)S	S=.24	—3886.30	—5976.00	—6955.20	—7024.08	—6688.00	—6890.20	—6870.40
Eleven	H=W(T—t)S	S=.22	17336.00	17336.00	17336.00	17336.00	17336.00	17336.00	17336.00
Totals			93171.40	95113.01	169301.80	200103.74	175888.75	244197.6	372881.76

From entrance at the kiln to the point of highest temperature, a distance of 17 ft., 1.7 seconds.

From point of highest temperature to 1500° C., a distance of 17 ft., 1.7 seconds.

From 1,500° C. to 1,100° C., a distance of 20 ft., 2.4 seconds.

From temperature point of 1,100° C. to 812° C., a distance of 20 ft., 3.1 seconds.

From temperature point 812° C., to 500° C., a distance of 10 ft., 2.1 seconds.

From temperature point of 500° C. to the exit of the kiln, a distance of 15 ft., 2.4 seconds.

Total time occupied by the gases in traversing the kiln, 10.6 seconds.

The general assumption has been that an excess of air is present in the rotary kiln. Richards stating that in one kiln he found an excess of 132 per cent.; Carpenter gives the excess in another kiln at 44 per cent. These statements, based on analyses of the flue gases taken from the stack, I do not believe to be correct, as no correction apparently was made for the air entering the flue at the kiln connections or through any openings in the brick work. This amount is considerable and vitiates any deductions that may be drawn from the analyses of gas taken from the stack.

Mr. W. Elwood Snyder in the February issue of the "Cement and Engineering News," gives three analyses; the first, which was taken from the stack 5 ft. above the flue, reads as follows: CO_2, 12.40 per cent. by volume; oxygen 10.00; CO, 00.00; nitrogen, etc., by difference, 77.60; indicating 94 per cent. excess air in the kiln, if it accurately represented conditions in the kiln.

Sample 2 was drawn from the stack in the same manner, after all the openings were closed as tight as possible, and shows: CO_2, 14.20 per cent.; oxygen, 9.40 per cent.; CO, 0.05; nitrogen, etc., by difference, 76.35, equivalent to an excess of air of 86.1 per cent. in the kiln.

The third sample was taken directly from the kiln and shows the composition of the gases to be: CO_2, 29.30 per cent.; oxygen, 0.70; CO, 0.40; nitrogen, etc., by difference, 69.60, showing only the theoretical amount of air required for complete combustion in the kiln.

In Europe the practice is to burn with a slightly reducing flame, and I think that few kilns here are in reality using much more than the theoretical air requirement for complete combustion.

It has also been stated that the wet process renders a considerable excess of air advisable, the argument being the excess air would be useful in evaporating the moisture. This, however, I think incorrect, as hot air in practice cannot be charged to half its theoretical saturation, and the greater portion of the heat used in raising the temperature of the excess air would be lost. The much quicker and more economical method is to raise the temperature of the raw material to boiling point and keep it there. The higher the temperature of the gases the more perfect will be the transference of the heat to the slurry, and their dilution by air in excess of that required for combustion would either lower their temperature or require more coal to raise them to the desired temperature.

Abandoning abstract discussion and turning to the study of table I, you will find a tabulated comparison of the theoretical with the actual results obtained with the rotary kilns in seven widely separated plants, using different materials and operating under varying conditions.

No. 1 shows results obtained in Cuba manufacturing from a mixture of chalk and clay by the dry process; the tabulated figures give the average results of one month's run of two kilns.

No. 2 is a plant in Germany manufacturing from a mixture of hard limestone and clay by the dry process; the tabulated figures give the average results of the operation of 12 kilns for the two days the writer spent at the works.

No. 3 is a plant in Germany manufacturing by the wet process from a hard marl and clay, the material being midway between our marls and chalk in its physical characteristics. The tabulated figures give the average results of the operation of four kilns for nine months.

No. 4 is a plant in France manufacturing from chalk and clay by the wet process; the tabulated figures give the average results of the last six months' operation of the one rotary kiln in the works.

No. 5 is a plant in the north of England manufacturing from chalk and clay by the wet process; the tabulated figures give the average results of the operation of two kilns. It should be borne in mind, in considering the figures in this case, that the kilns are shut down every Saturday night and started Monday morning, thus increasing the coal consumption.

No. 6 is a plant manufacturing by the wet process from marl and clay in the Middle West; tabulated figures give the average results of a season's run.

No. 7 is a plant manufacturing by the wet process in the Middle West with marl and clay, the marl containing a large percentage of vegetable matter; the tabulated figures give the average results of a two months' run.

The fourth line of the table gives the consumption of coal per barrel of 380 pounds, the weight being that of the coal as it is delivered to the plant, including moisture, etc.

The sixteenth line gives the commercial weight of the coal required to produce 100 pounds of clinker.

The seventeenth line gives the coal consumption calculated on a uniform basis of 7,500 pound-calories per pound of coal.

The eighteenth line gives the total number of pound-calories in the fuel used to produce 100 lb. of cement clinker.

The nineteenth line gives the calculated number of calories required theoretically to perform the work necessary to be done in the kiln, calculated on the basis of theoretical air supply and a stack temperature of 500° C. for the dry process and 260° C. for the wet.

The table shows the liability to error in drawing deductions from any ordinary statement of coal consumption. No. 1 shows the use of 24.2 lb. of coal per 100 lb. of cement produced, while No. 2 shows 27.1 lb. of coal per 100 lb. of cement produced, indicating apparently a more economical operation in No. 1 than in No. 2, yet when the coal is reduced to a uniform basis of calories per pound of fuel, No. 2 while using 3 lb. more coal commercial weight per 100 lb., is actually burning with one pound less when reduced to uniform calorific value.

No. 2 gives the actual efficiency of the kiln alone and not of the complete installation; each of the kilns is connected to a boiler evaporating between 1,350 and 1,400 lb. of water per hour into steam at 150 lb. pressure from the heat supplied by waste gases of the kiln, there being no provision for direct firing. This is equivalent to the utilization of about 37,000 lb.-calories per 100 lb. cement produced, which would make the efficiency of the entire installation over 77 per cent.

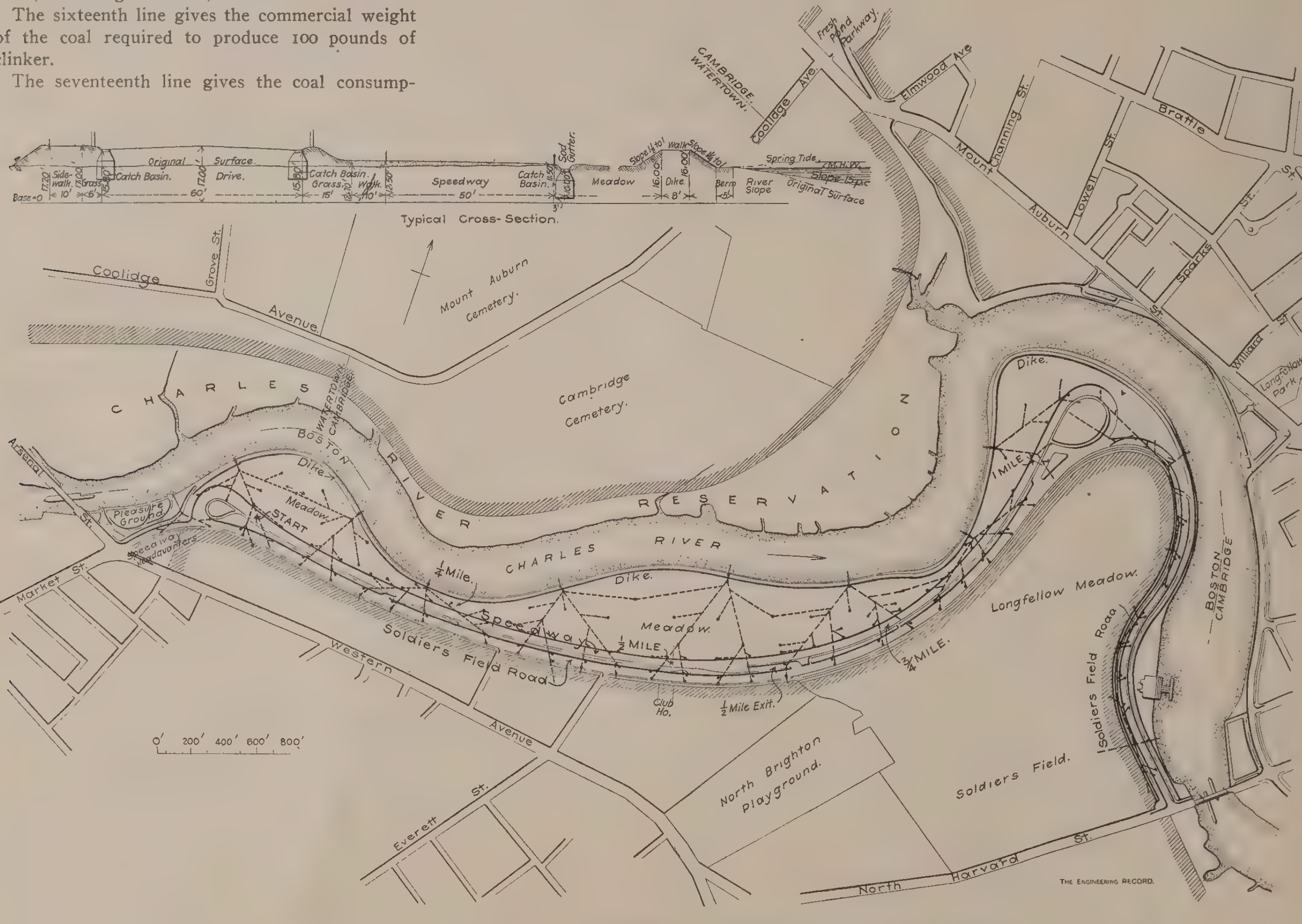
In conclusion, I wish to express my indebtedness to my associate, Mr. F. J. LeMaistre, for his assistance in the preparation of this paper, and my appreciation of the courtesy of the manufacturers in giving me the actual results of operation, which alone made the preparation of this paper possible, and state my regret at not being able to secure like data covering the operation of the longer kilns in the Lehigh region and marl mills of the West, which would have made the table fully comparative.

A Novel Drying Apparatus was recently furnished the Bureau of Engraving and Printing, at Washington, by the B. F. Sturtevant Co. It consisted of a fan capable of handling 3,000 cu. ft. of air per minute, and a special form of heater designed to heat as a minimum 2,000 cu. ft. of air per minute from 32° to 200° Fahr., or a proportionately larger amount from a higher natural temperature. It was made a condition that the coils should be so completely enclosed with ample thickness of asbestos, and so thoroughly insulated, as not to transmit heat to the room in which they were placed. These somewhat difficult conditions appear to have been met with success.

The Charles River Speedway of the Boston Metropolitan Park System.

By Wm. T. Pierce, M. Am. Soc. C. E.

All roads for general use should possess certain qualities about which there can be little difference of opinion, but roads for special classes of travel should have variations from these that they may be adapted to the prevailing type of travel. A roadway surface may be ideal for motor vehicles, and yet defective for ordinary traction, unless it gives suitable footing for horses. Then again, a street adapted to a heavy traffic may be a poor road for light travel—the hard, unyielding surface of the one were better if given more elasticity in the other. The quality of resilience should be given consideration, and attained in pleasure drives even when involving some sacrifice in durability and increase in cost of maintenance. The hard, unelastic coatings on many park roads are such as to detract much from their full enjoyment as pleasure drives. The thin cushion of loam or fine gravel sometimes spread on a broken stone roadway is an improvement in some instances, especially if used for speeding horses, but, for "a public road set apart for fast driving," it is a makeshift, and is an attempt to secure certain results better obtained in construction by some other method.



General Location of the Charles River Speedway of the Metropolitan Park System of Boston.

Public streets, parkways and park roads are unsuitable for fast driving, because of interference and danger to other travel, and they are seldom suitably built for that purpose. The popularity of the sport has resulted in the expenditure of large sums and the construction of special roads in all large communities to be used solely as public speedways.

In the takings for the Boston Metropolitan Park System one section of the Charles River marshes seemed so admirably adapted for a speedway that its use for this purpose was early considered and its construction decided. Located in the Brighton District on the right bank of the river, between the upper end of Western Ave. and North Harvard St., it is easy of access and only 4¾ miles from the State House by existing streets. It makes a link in the practically continuous takings of the shores of Charles River, and will form a portion of the parks and drives surrounding the new Charles River Basin, and extending many miles up the river to the limits of the Metropolitan District. Its length permits a mile track on a long, easy curve, almost a "straight away," and the two large cemeteries on the opposite side of the river may be regarded as permanent barriers to any possible future interference by cross streets.

View Showing Half-Mile Exit from the Charles River Speedway

The average length of the section taken for speedway is 1.88 miles, average width about 400 ft. and area 92 acres. About 80 of the 125 acres of the original salt marsh area between the limiting public streets comes within the area taken. The river here is tidal, with average tide of about 10 ft. The marsh before its reclamation was between levels 10 and 11 ft. above Boston City datum, or at about average level of high tide, while spring tides covered it with 2 to 3 ft. of water. The resulting admixture in the river of sea water from the harbor below and of fresh water from the upper river is about half and half.

The construction of Charles River Dam, or "Barrage," at Craigie Bridge, will make this portion of the river a fresh-water lake 8½ miles long, with a fixed water elevation 2 to 3 ft. below marsh level. Measured by the thread of this proposed basin the two ends of the speedway section will be respectively 4.10 and 6.13 miles up from the new dam. Its boundary, on the landward side, follows the general trend of the river and 7/13 of its length curves around the Longfellow Meadows and Soldiers Field, the athletic grounds of Harvard College.

View towards the West from a Point Opposite the Quarter-Mile Post.

The general plan of development was designed by Olmsted Brothers, landscape architects, and carried out under the supervision of the engineer of the Metropolitan Park Commission. A sidewalk and roadway 1¾ miles in length, called Soldiers Field Road, follows the boundary, and serves as a park drive and as a means of access to the abutting lands, and also for the return travel from the speedway exits, racing being allowed on the track only in one direction. The 10-ft. sidewalk is separated from the roadway by a 6-ft. grass strip, with its row of elm trees spaced about 50 ft. apart. The portion of roadway entering from Western Ave. and alongside the speedway is 60 ft., and the remainder to North Harvard St. 40 ft. wide. The first half abuts private property and its established grade is at level 17, Boston City datum, about 6 ft. above marsh surface; the other half, along Harvard College lands, was built to level 13, but has settled to an average level of 12 (1902). The higher level is admirably adapted for viewing the racing on the track, but slightly above marsh elevation. Parallel with the broad portion of Soldiers Field Road is the Speedway for the requisite distance, separated therefrom by a 15-ft. grass strip, with another row of elms and a 10-ft. walk next to the Speedway fence. The track is 50 ft. in width, one mile in length, with allowances for scoring ground and finish, and has a suitable entrance and exit. An additional exit near the middle allows of its use as a ½-mile course, if desired, and an extra entrance near the ⅛-mile post gives a still shorter course to be used only in the sleighing season. The meadow between speedway and dike remains unused, except at the end near Western Ave., where was constructed a small public playground and gymnasium in 1904. A dike along the shore line protects the entire area from high water, and ample drainage is provided. The irregular shore, with its muddy banks, has been given even curving lines with slopes having a gravel finish.

The peat composing the marsh had a very compact and firm surface, although soggy with water. An average sample just after being taken out 1½ ft. below the surface weighed 77 lb. per cu. ft., and after drying 4 months in the field office weighed at the rate of 27 lb. per cu. ft. Filling material, except such as came from the premises, was obtained by dredging in the river, and was distributed from the hoppers erected on the shore by cars and engines run on tracks laid on the marsh. This material was clean, coarse gravel, weighing 127 lb. per cu. ft. The border road had a 5 to 6-ft. fill for a distance of 4,500 ft., and was made on peat and mud with a maximum depth of 13 and an average of 5.5 ft. This fill has remained since completion very closely at the established grade. During construction there was a slight bulging up of the marsh on one side only for a distance of about 100 ft. The remaining 4,700 ft. of this road had an established grade about 2 ft. above original marsh level, and was made on peat and mud with a maximum depth of 21 and an average of 13.9 ft. Drainage and subgrading work began early in 1898, and to the time of the completion of the surfacing contract in August, 1899, the settlement on this portion with light fill had been from 3 to 7 ft. At one place the subgrade was brought up 5 times, and the following year still more work was done in bringing up these settlements, and the extreme settlement here to date has probably been as much as 10 ft. The roadway has a 5-in. surface of broken stone, and a thin layer of fine binding gravel. Horse rollers were used at first in surfacing for fear of excessive settlements, but this precaution was found unnecessary, and regular steam road rollers were used later. Catch-basins are on each side, spaced 200 ft. apart, and, as the center profile is level, except for short distances at the ends and middle, the gutters are given a slight pitch toward each pair. Tree pits are 4 ft. square and 4 ft. deep, refilled with good, rich, black loam, and those along the lower grade are connected with the underground drainage.

The track, or speedway proper, is at an elevation above the marsh only sufficient to secure its drainage. The alignment is a continuous curve in one direction with radii varying from 1,860 to 7,625 ft. In profile it is level, and in cross section 50 ft. wide, with a pitch of 1 ft. towards the inside of the curve. This cant will counteract the effect of the sharper curve at a 2.30 gait. (Formulæ, for 2.30 time, $e = 38 \div R$, or tan. $a = 241 \div Rt^2$, Baker's "Roads and Pavements.") A sod gutter was formed on the marsh just outside the pole or fence, sloping to catch-basins opposite those on Soldiers Field Road. No underdrains pass under speedway. The subgrade was made up with firm peat sods from drain trenches compactly packed in place. The surface was formed with rich, black loam, rolled with horse rollers into a 4-in. layer. Rolling was with horse rollers and generally done at night, as better results were then secured, the loam then retained its moisture without being sticky, and was in just the right condition for working. In the spring of 1900, after its public use the previous fall and winter, much regrading was done, rectifying settlements and changing somewhat to allow of the extra exit for the ½-mile course. Sods not being available, and because of light weight and low cost, soft coal cinders, found to weigh 59 lb. per cu. ft. were used at this time for bringing up settlements to subgrade, and to the rolled loam surface was added a thin layer of very fine gravel, worked into the loam by light scratching with harrow and then again rolled. The result has been very satisfactory, the track is "very fast," and can be used in all weathers.

The water supply for sprinkling purposes is taken from the Boston system. Six thousand eight hundred and sixty feet of 4 and 3-in. pipe and 10 standpipes were used for this purpose at a cost of $3,800.

Because of the proposed permanent water level in the river the drain outlets were kept as high as possible, but will even then be slightly below water surface. The total drainage area is 190 acres, assuming that the two public streets, which enclose this section of private, public and college lands, will intercept their own surface water and that from back areas. Drains are extended through the border road to relieve back land. The 42 acres of meadow between dike and speedway have 9.8 miles of underdrains, and with the 4.1 miles of other drains give a total of 13.9 miles. There are 11 outlets into the river: 1 of 12, 6 of 18, 2 of 20, 1 of 24 and 1 of 30-in. cast-iron pipe, which are, together with the gate chambers, supported on piles. The depth of peat and mud overlying clay or gravel strata at outlets was from 5 to 23 ft., average 15 ft. Gate chambers are located in center of dike, each with a middle partition, and two sets of tide gates. Underdrains are placed on boards laid lengthwise in trench, other drains and catch-basins are on timber platforms laid on sills, all being bedded and backfilled with clean, coarse gravel. All drains are of earthenware pipe and laterals of underdrains are of 4-in. pipe laid in parallel lines about 40 ft. apart, with upper ends 2 ft. below surface. Pipe joints are without mortar, except under roadways, banks and other structures. No extra storage capacity was provided in drains to care for storm water when tides close outlets. The meadow between track and dike is freely connected with the drains by speedway catch-basins, extra gratings on marsh and gravel backfilling, and its flooding with fresh water would do no damage nor rise on to road surfaces. Ground water now stands 2 ft. below surface along line of speedway. The dike was finished in December, 1898; since then the salt water of the river has been excluded and the marsh reclaimed. A small portion has been successfully cultivated, and other portions have a thriving growth of small birches self sown. In the summer of 1904, 5½ years after reclaiming, 7 lines of levels were taken across this area, formerly a salt marsh, and the elevations compared with those of topographical survey made previous to the improvements; the settlement was found to range from 0 to 11 in., average 6 in. The surface is dry, firm and well drained.

Trees were set out in the spring of 1900 under the advice and supervision of the landscape architects: 512 elms in rows along the drive and 344 other trees of various species scattered irregularly on the meadow. The former have throve, and are in good condition, but the latter are dead, probably due to the insufficient freshening of the marsh at that time.

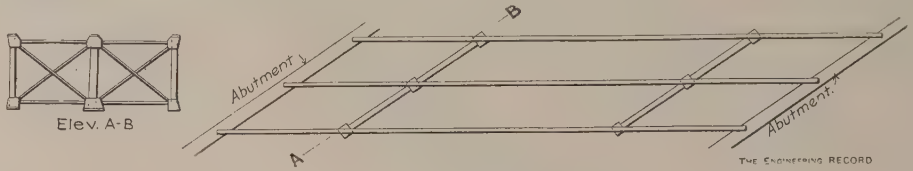
The dike follows the shore closely with a 5-ft. berm outside, is 2 miles long, has been successful and without a visible leak, and with only very slight settlements. Its base is 24 ft., and its top, at level 16, is 8 ft. wide, and used as a walk. Before building the surface was plowed for a width of 4 ft. The clay and gravel core was well compacted over these furrows, the outer slope having 3½ ft. depth, and the inner one 1 ft., of peat sods; the outer facing was done with sods of good depth carefully placed. Now that the dam lower down the river is assured this dike will be only temporary; but even so, a cheaper structure of sods alone would have been unwise and would have had breaks if subjected to freshets and high tides, like what occurred in 1886 and 1898, and great damage would have resulted. The cost of dike was $3.38 a lin. ft., including engineering and inspection.

In regarding the shore slope it was made to conform to the lines established by the U. S. Government, and as a sanitary and æsthetic measure was given a durable slant with gravel surface where unpaved. Except for a short distance at the upper end, where it is much steeper, the inclination of the finished slope is 15 per cent. from marsh level down to mean low tide. Where this rate is 25 per cent. or more, the slope is roughly paved with stone, as has been found necessary on other portions of the river shores. Included in the shore work was 79,380 cu. yd. of excavation and dredging, 3,610 sq. yd. of stone paving, and the furnishing of 50,250 cu. yd. of gravel. The shore was completed December, 1899, at a total cost of $7.94 a lin. ft.

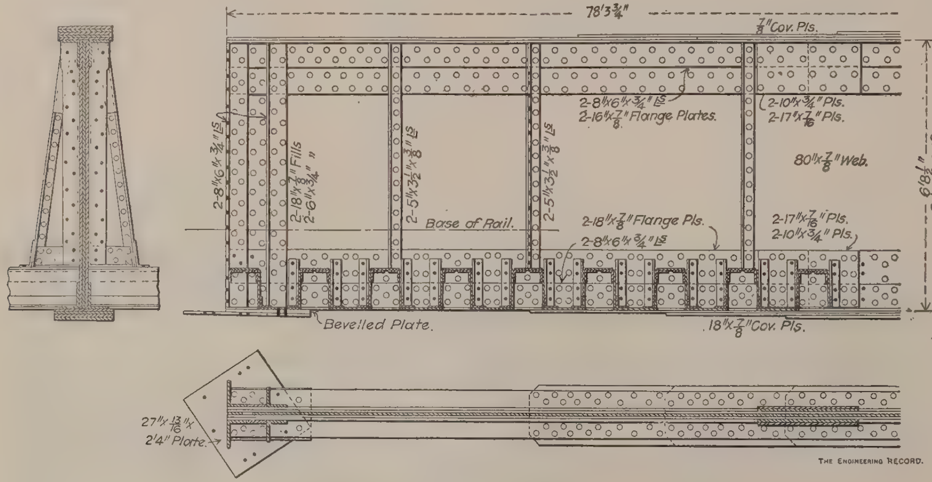
Excavated material from the premises and shore was utilized in filling of creeks, filling the speedway to subgrade and in facing the dike. The small surplus has been placed in spoil banks on the opposite shore. The total cost of construction outlined above has been about $450,000, of which amount 3 per cent. was the cost of engineering and inspection. At the Western Ave. end, on a lot secured for the purpose, are a group of buildings used as office, superintendent's house, police quarters, stables, tool house, sheds, etc. The use of the speedway increases each year, and has now become very popular, and will be easier and pleasanter of access to the driving public when further shore work has been completed and the river drive extended.

The Chew St. Double-Track Plate Girder Bridge, at Walnut Lane.

The bridge of the Germantown & Chestnut Hill branch of the Philadelphia & Reading Ry. over Chew St. at Walnut Lane, Pa., is a three-span, double-track, through plate-girder structure. The three 78-ft., 3¾-in. center span girders are supported on the caps of six vertical columns about 14 ft. long, which also receive one end of the short span girders, supported at the other end on the masonry abutments. Each column has an H-shaped cross-section made with a web plate, two flange plates and eight flange angles; the three columns in each bent are X-braced together by pairs of angles latticed, and have horizontal top and bottom channel struts.



General Plan and Elevation.



Details of Girder and Solid Floor.

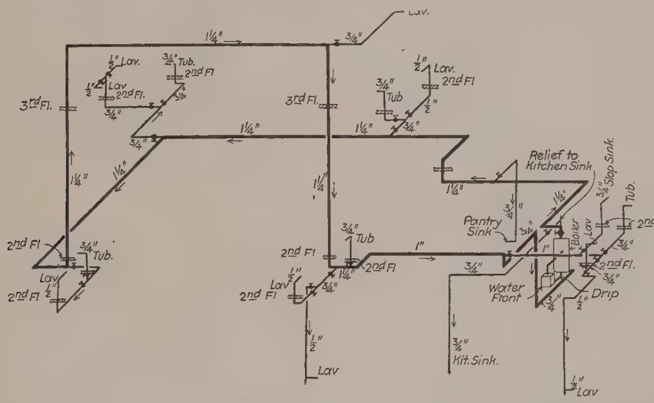
The main girders are very heavy for their dimensions, and have web plates 80 in. deep and ⅞ in. thick in 15 to 18-ft. lengths, spliced with pairs of 14x½-in. cover plates, with four vertical rows of shop-driven rivets.

The maximum flange section consists of two 18x⅞-in. side plates, two 6x8x¾-in. angles, and five 18x⅞-in. cover plates. The cover plates and angles are made in single pieces; the side plates are made in two pieces each, with the joints staggered on opposite sides of the web, but opposite each other in the top and bottom flanges, and spliced in each of the four places by two cover plates and two fillers. The ends of the girders are field-riveted to the side-span girders through the vertical web-stiffener angles, and the girders are connected by transverse rectangular floor troughs made with 8-in. top plates, 11-in. side plates and 12-in. bottom plates. Their bottom plates are flush with the lower flanges of the girder and they are field-connected to its web by four field rivets in a vertical angle at each end of each plate. The vertical web stiffeners are cut to clear the floor troughs, and at alternate panel points are connected with them by narrow gusset-plate kneebraces with flange angles. The bridge was designed and erected under the direction of the engineering department of the Philadelphia & Reading Ry., Mr. W. Hunter, chief engineer, and was built at the Pencoyd plant of the American Bridge Co.

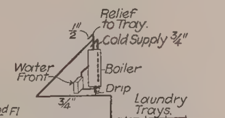
THE WEAR OF A TURBINE which is supplied with water under 443 ft. head from a jet which is divided into independent streams by blades in the nozzle was discussed recently in "L'Eclairage Electrique." The extreme ends of the blades are little affected, but toward the center there are three deep grooves, which are attributed to a possible action of eddies set up in the jet and not to the presence of sand.

Sanitary Engineering Work in a Large Residence.

The complicated modern sanitation of a large residence is well shown in the design of the plumbing, heating, ventilation and lighting systems for the home of Mr. Oliver H. Story, Chestnut Hill, Mass. The accompanying plans show the irregular wall lines of the main part of the house, which is of U-shape, with a service wing extending from one of the sides. In the main basement are the vegetable cellar, wine room, room for furnace coal, and a large room for heaters, lift and other apparatus. In the service wing basement are the laundry, drying-room, preserve closet, bin for range coal, etc. On the main floor are the living, billiard, reception, breakfast and dining rooms, butler's pantry, den, toilet and coat-room, and the main hall, 40 ft. square, extending upward to an arched roof some 2 ft. above the ceiling of the second floor. On the main floor of the service wing are the kitchen, pantry, servants' hall, stores and butler's room. On the second floor is the owner's suite, consisting of owner's room and boudoir, between which are two toilets and two large clothes closets as well as an entrance hallway. On the opposite side is the sons' suite of two bedrooms connected by a short hallway. In the front of the house are three guests' rooms and two baths. A broad gallery circles the hall area. The service wing has six servants' rooms, one bath and a sewing room. The two principal rooms on the third floor are the guests' room, bath and boys' playroom.



Diagram, not to Scale, of Hot-Water Piping System.



Laundry Hot Water System.

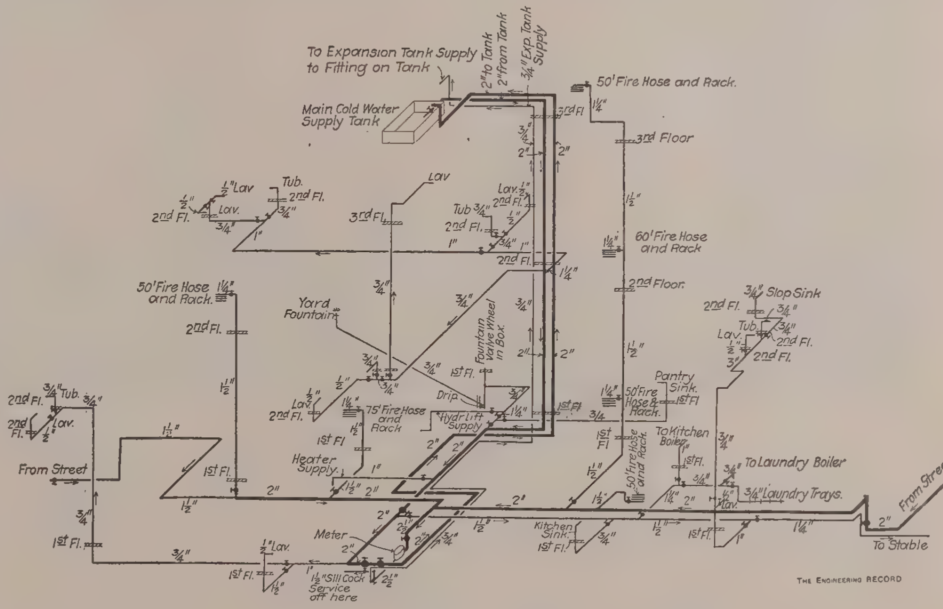
The house is located on high ground, with a view of the Blue Hills, its total frontage being about 150 ft. The building has a heavy, dry stone foundation and 12-in. brick walls above surface grade. The brick is lined inside with 2 in. of terra cotta. The roof is of slate.

The stable, of the same construction as house, has a large inner court, with two entrances. There is a square cellar for a heater and coal under the kitchen and living room, which constitute a portion of the first floor. On this floor are the automobile, tool, harness and cleaning rooms, also the stall room and the carriage house. On the second floor are three bedrooms, a bathroom and a large hay and storage loft. The stable was built to accommodate from three to four persons and seven horses.

Plumbing.—The nine toilets and bathrooms and a second-floor slop sink are served by five rising lines of extra heavy cast-iron piping. These are combined in the basement to one main soil line leading to a double-hub running trap in a cleaning manhole placed some 6 ft. outside of the service wing in the kitchen yard. The piping includes a cast-iron soil and waste drainage system, fresh air inlet, and an air relief system for each trap. There is also a galvanized iron seat ventilation system carried downward to the basement and thence to the kitchen flue.

The water supply is brought to the basement in a 1½-in. and a 2-in. pipe, which are united before the water passes through the meter. All water piping in the basement is of tin-lined, galvanized, wrought-iron pipe, and above the basement it is of iron-pipe-size brass. Hot water is supplied by a combined hot-water heater and laundry stove placed in the laundry. As the water pressure is at times barely sufficient to supply the third-floor bath, a 1,300-gal. copper-lined tank has been placed near the roof and the piping so arranged that all of the house fixtures may be supplied by the tank or by street pressure as desired.

In order to procure the pressure necessary to operate the three needle shower baths, one of which is on the third floor, a hydraulic lift has been placed in the basement, and a separate system of hot and cold water piping of brass runs to the fixtures. The water to be heated passes through an independent hot-water tank in the basement The waste from the lift supplies a small yard fountain and reservoir. A separate galvanized, wrought-iron fire service supplies outlets with concealed hose and nozzles on each floor, and a lawn sprinkling system of brass piping supplies the sill cocks and lawn boxes.



Perspective Diagram of Cold-Water Piping System.

Independent galvanized wrought-iron drips serve all service rising lines and storage tanks, as well as troughs under all service pipes in floors. Each drip pipe has a tag stamped with line it serves. A wrought iron pipe line on basement ceiling collects the rainwater from 21 copper rainwater leaders and carries it to a basement manhole, from which an Akron pipe runs direct to a large dry well 75 yards below the house.

All bathrooms have tile floors laid in cement, with walls tiled up 5 ft. The fixtures in all cases, except those in the service wing, are of heavy porcelain throughout, having wall wastes and supplies. The lavatories are of the pedestal pattern, or leg and bracket design, setting out slightly from the walls to facilitate cleaning. The water closets, of the siphon-jet type, are supplied by flush-tanks concealed in the floor above, with supply pipes in partitions and operated by porcelain wall-lever pulls, only a small amount of metal work being visible and that being silver plated. All bathtubs have supply and waste handles on an engraved metal wall plate, the closing valves being placed in a partition box accessible for repairs from the other side of the partition. The fixtures in the service wing are of heavy enameled iron.

As in the house, the stable soil, waste and air piping is of extra heavy cast iron to the stable running trap. The water is supplied from the house after it is metered, and is run in galvanized iron pipes to the stable fixtures. A hot water boiler connected to kitchen range supplies the bathroom, kitchen, pantry, harness and wash-rooms. In the carriage house is a revolving carriage washer placed directly over the carriage room drain. The stalls are provided with patent sanitary iron troughs leading direct to the main soil run in the granolithic floor of stall room and carriage house. The troughs are covered with 3-in. rock maple grated floors.

In the stable toilet room are a porcelain enamel lavatory and 5 ft. bathtub and an earthenware siphon-jet closet. On the first floor there is a soapstone kitchen sink, an enameled iron pantry sink, a closet similar to that on second floor, an iron harness-washing sink and a dip sink.

The stable rainwater leaders are collected in a system of Akron pipes, in which the water is run off to a dry well near the tower corner of the stable.

The soil from the house running trap and that from the stable running trap are brought together in a junction manhole 15 ft. to the rear of kitchen yard wall, and thence by a single 6-in. Akron pipe to street sewer.

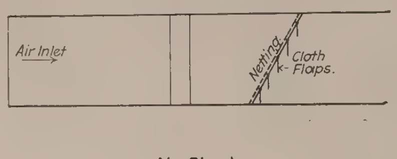
Lighting.—The house is wired on the three-wire system for alternating current at 110-220 volts, run in iron conduit, with iron boxes at all switch and light outlets. The switches are of 10 ampere capacity and of the flush-rotary, single-pole type, and so connected as to break the side of the circuit connected to the outside wire of the three-wire system. Two cut-out cabinets are placed on the first floor, and two on the second. The service cabinet is placed directly under a toilet in the basement and contains the service switch, meter and three 100-ampere, three-wire, enclosed fuse blocks. The cabinet is lined throughout with ⅛-in. asbestos, thoroughly secured to the wood with tacks and shellac. The lights on each circuit are shown on plans.

Over the door in each cabinet is installed a keyless receptacle in an iron outlet box with brass spinnings. Floor and side plug receptacles are placed in the different rooms, and in each bathroom is placed a receptacle for a small electric heater. The reception room is lighted solely by reflection from the overhanging cornice and a reflector with the lights placed behind it.

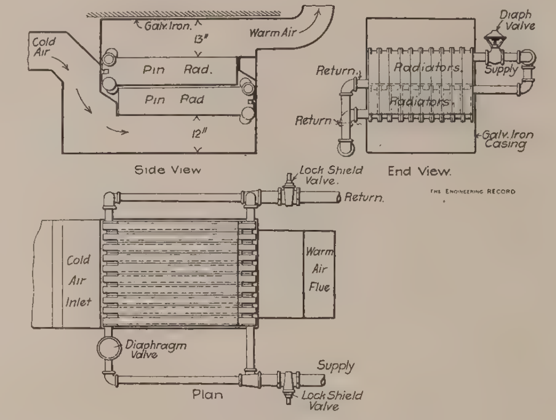
A unique feature of the design is the control by one switch in the owner's hallway of one light in each of the main downstairs rooms and hall. A cluster of two lights is placed over each dresser and operated by an adjacent switch.

The wiring in the stable is similar to that in the house. In addition, however, there is a motor-generator in the automobile house for charging electric runabouts. It has a 4-h.-p., 208-volt, 60-cycle, single-phase, alternating-current motor direct-connected to a direct-current, shunt-wound generator capable of delivering 30 amperes at all voltages from 40 to 80 volts. The machinery conforms to recommendations of the report of Standardization Committee of the American Institute of Electrical Engineers.

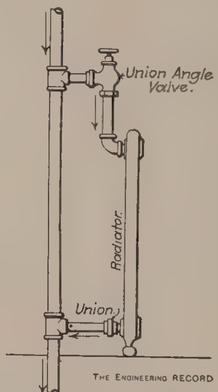
The total number of lights in the house is 388, which are controlled by 95 switches, including 5 four-way, 26 three-way and 64 S.P. In the stable are 46 lights, controlled by 19 switches, of which two are three-way and the rest S.P.



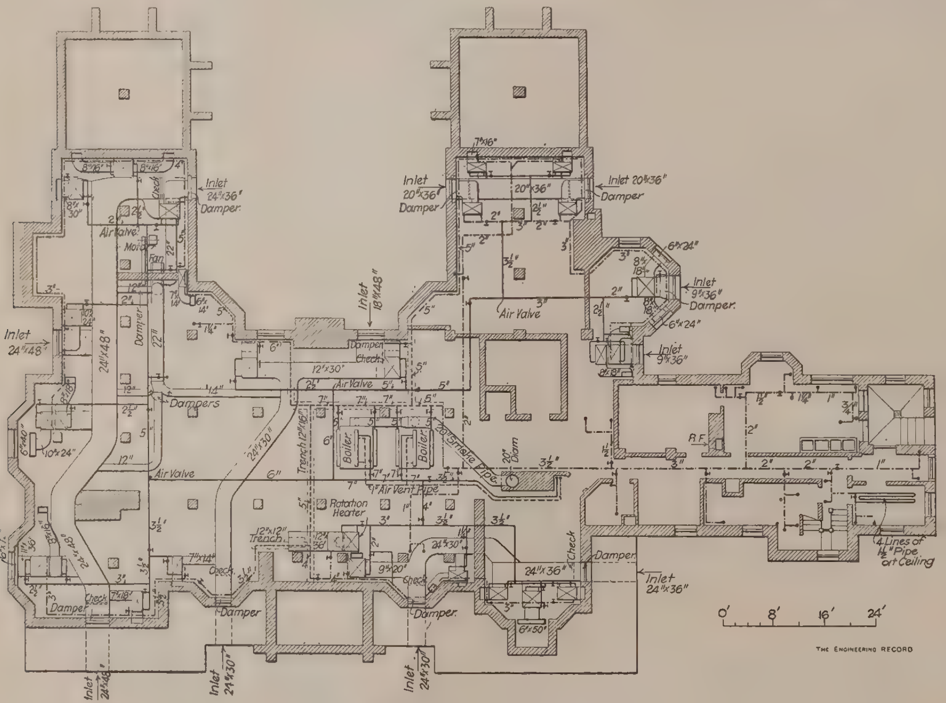
Air Check.



Typical Indirect-Stack and Casing.



Radiator Connections.



Basement Plan of Heating System.

Telephones.—There is provided a 10-station intercommunicating battery call telephone system (metallic circuit) run in unlined metal conduit heavily coated to prevent oxidation. All telephones and switches are of special design, the face of the telephone boxes coming flush with the wall finish, and the bells placed inside the telephone box, a nickel-plated grating covering a small bell opening. A desk outfit is provided for the owner's desk in the den. A 6-in. stable court-yard bell enclosed in a suitable box is connected to stable telephone circuit.

Heating.—A combination direct and indirect hot-water system was chosen as being the most satisfactory under the existing conditions. Two 14-section, cast-iron, Mercer hot-water boilers, centrally located in the main basement, supply the necessary heat. The cold air supply for the indirects is taken into a main trunk line from three sides of the building, excepting under the breakfast room and pantry, and distributed to the various stacks. The outboard openings are provided with dampers and are also covered with wire screens, directly back of which are hung cotton-flannel cold air checks which completely close the opening if the wind pressure is from the opposite side of the house. Each indirect heater is composed of two banks of pin radiators, the upper bank being thermostatically controlled and the lower one controlled by hand.

All of the ducts are of galvanized iron; where they are placed in an outside wall they are covered with two thicknesses of double-ply quilting. On the first floor indirect heat is provided for the living, billiard, reception, dining and breakfast rooms, hall and den. On the second floor indirect heat is supplied to all rooms with a fireplace and the two guests' bathrooms. All other rooms, including bathrooms, servants' rooms, etc., are heated by directs. Hot-water piping in the main house is concealed in wall slots and covered with wire lathe and plaster.

In case of a reception, where extra ventilation would be required, a 50-in. steel plate blower belted to an alternating-current motor may be connected to the main cold air duct. In very hot weather the fan may be used to good advantage in connection with a refrigerant. The general ventilation of toilet and bathrooms (in addition to the local seat vents) is through wall registers, which in the bathrooms are placed about 3 ft. from the floor and over the bathtubs. These registers connect with galvanized iron ducts which are carried to brick flues on the third floor. Near the front door in the main hall floor is placed a rotation register which continually reheats and keeps in circulation the cooler air near the floor. Twenty-two thermostats are placed in the important rooms, with which a complete system of pneumatic control is connected.

A 7-section, Mercer cast-iron steam boiler is used to heat the stable. It is placed in the stable cellar in a brick pit 1 ft. deep in order to provide sufficient headroom. The rooms are warmed by direct radiation, wrought-iron coils being used in all except the living rooms. The coils are either ceiling or wall.

Dial Cabinet.—The gas, water and recording watt-meters are placed in the basement of the main house directly under the owner's den. It has been so arranged that the three dials are brought into the den and placed in a glass-covered cabinet. In addition to these three there are hot-water altitude and pressure gauges, a thermostat and hot-water temperature thermometers. In this way the owner is kept directly informed of the operation of the different systems.

Mr. Andrew D. Fuller is the consulting engineer for the building. Messrs. Chapman & Frazer are the architects. Mr. S. Homer Woodbridge is the associate engineer on the heating and ventilating work.

Deep Pneumatic Foundations at a bridge over the Barrow River in Ireland have been executed by a method described in "Engineering." Seven piers had to be carried down to depths of 117, 114, 113, 109, 107, 105 and 103 ft. below high water, respectively. The pressure due to a depth of 117 ft. is 50 lb., which is considered beyond the limit of human endurance. Sir Benjamin Baker, Sir Wm. Arrol and Mr. A. S. Biggart, who were responsible for the construction, accordingly made use of ejectors for contending against leaks in the working chamber and employed a lower pressure than that of the hydrostatic head. The final pressure in the deepest pier was 43 lb. Little difficulty was experienced by the men in working at this pressure.

Old-Time Rapid Bridge Erection With a Traveling Falsework Span.

The single-track high bridge of the Norfolk & Virginia Railroad Co., across the Appomattox River, near Farmville, Va., originally consisted of 21 112-ft. deck spans supported by high brick piers, with masonry bases and short iron towers, carrying the track at about 100 ft. above the level of the ground in the middle of the valley, and about 117 ft. above low water level. The spans were of the Fink truss type, built of wrought iron, with Phœnix columns and cast-iron connection blocks, and were seated on towers of similar construction about 20 ft. high. The superstructure was designed for light rolling stock, and was built before much progress had been made in designing details which would develop the full strength of the members and avoid secondary or eccentric stresses. After the bridge had been in service sixteen years it was found to be too light for the increasing weight, frequency and speed of trains, and in 1886 the superstructure was replaced on the old sub-structure, without material interruption of traffic, by much heavier steel Pratt truss spans of the same length, height and width. No part of the old superstructure was retained, except the towers, which were left in place on the pier tops to support the track stringers between the hip points of the adjacent span top chords.

In order to avoid the expense and delay of building high false works, a novel system of erection with a traveling falsework span was adopted, and proved very satisfactory, owing to the light members to be handled and the uniformity of the spans. Between one abutment and the first pier two 20-ton combination Pratt trusses 112 ft. long and a little less deep than the new trusses were erected on low falsework or blocking, one each side of the old span, just clear of the old trusses, outside. They were not, at first, provided with any transverse members or sway bracing, but their top chords were suspended by vertical screws 7 ft. long and 1¼ in. in diameter, from the cantilever ends of seven horizontal compound wooden girders about 24 ft. long, which were supported at their centers on ordinary four-wheel trucks on the standard gauge track across the bridge. Each girder consisted of a pair of 12x12-in. timbers side by side balanced transversely across the center of a truck. Cross-pieces connecting their upper sides afforded bearing for a third parallel 12x12-in. timber on their center line with holes through the ends for the vertical rods.

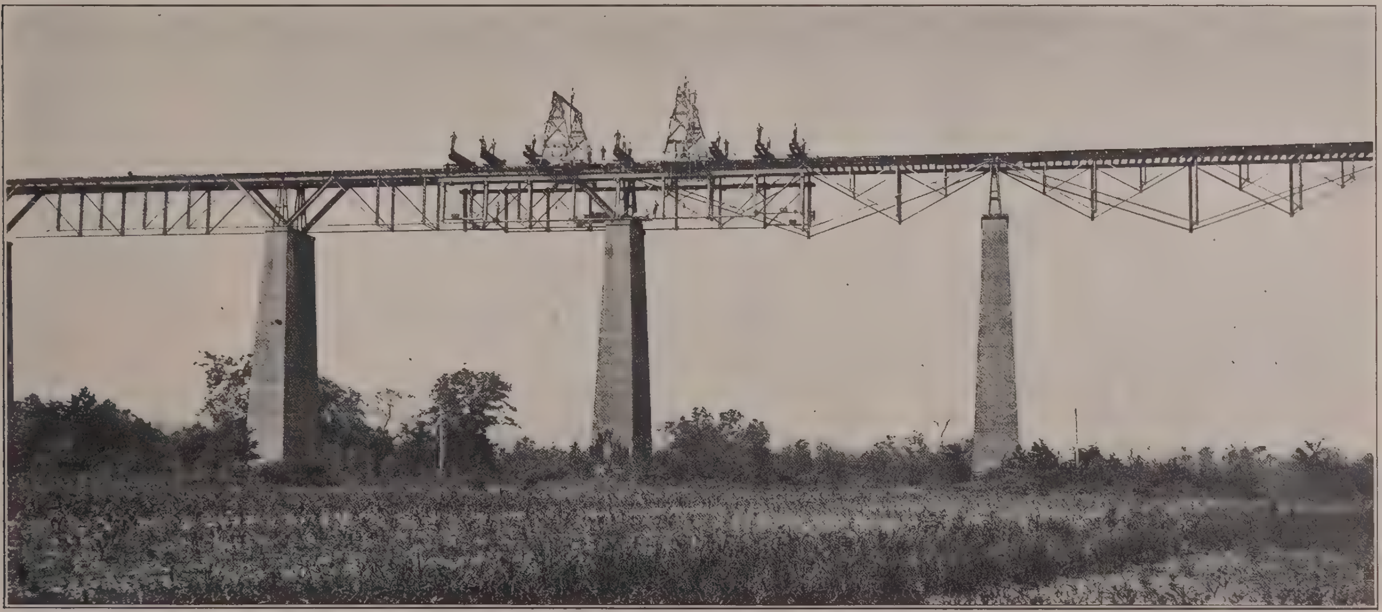
Intervals of from 1 to 4 hours occurred between the scheduled trains, and in one of these the screws were simultaneously operated by two men each, who in about ten minutes raised the trusses 6 in. and transferred their weight to the old span, which was, of course, well able to sustain a load so much less than the ordinary train load. Longitudinal spacing timbers were clamped to the trucks and made a rigid system, which was pulled forward by a single 4-part manilla rope tackle with its fall line operated by a locomotive. A pair of gantries, one on each side of the middle truck, were pulled forward with the falsework trusses until the ends of the latter were over the centers of the first and second piers. The locomotive was then released, the nuts slacked on the upper ends of the vertical screws, and the trusses lowered to bearing on pedestals previously placed for them on the ends of the piers outside the positions of the new permanent trusses.

Transverse struts and diagonal rods were inserted between the members of the old span and connected to the panel points of the falsework trusses, giving them independent stability, all connections being rapidly made with nuts and screws allowing quick adjustment and simple engagement. Meantime the cantilever girder trucks were pushed off the bridge to a yard siding and the main track was open for traffic which cleared the gantries. The upper transverse struts consisted of 8x16-in. timbers about 6 ft. apart and were set across and bolted to the new truss top chords, serving as floorbeams on which the railroad track was blocked up clear of the old span, thus transferring the traffic to the falsework span. The old trusses were then connected to the falsework span, their panel points disconnected and their members removed by the gantries and run off the bridge on trucks on the railroad track between trains.

By substantially reversing these operations the members of the new trusses were brought in from the storage yard, lowered by the gantries and connected together, being supported from the falsework span until completely assembled and ready to swing. The new floor system was assembled and the track bearing transferred to it, the wooden floorbeams and all transverse struts and diagonals removed and the falsework trusses cleared from the new span. The cantilever girders were brought out on the new span and the girders revolved 90 degrees on the trucks into positions transverse to the bridge axis. The vertical screw rods in their ends were connected to the falsework trusses, screwed up about 6 in. and lifted the trusses clear of their pier supports. The trucks were then moved forward one span, carrying the trusses to the next piers, and the cycle of operations was repeated, and so on until the superstructure had been rebuilt from one end to the other by about fifty men working 46¼ days.

In some instances the falsework span was moved in 70 minutes, in others it took as long as 160 minutes. In a number of instances one span was replaced and the falsework span moved forward ready for the next in exactly two days. The first shipment of steel was received May 22, 1886; the first new span was swung June 23; the last span was swung August 16, and the falsework span was taken ashore August 18, 1886.

The Edge Moor Bridge Works was the contractor for the manufacture and erection of the 1,482,894 lb. of steel work, which was designed according to the specifications and requirements of the engineering department of the Norfolk & Western Ry. Co. The late Mr. F. H. Smith was consulting engineer and contractor for the erection, which was done under the direction of Mr. J. W. Goodwin.



Moving Falsework Trusses of Appomattox Bridge Renewal.

Irrigation has received unexpected but no less welcome aid from the U. S. Court for the Colorado district. In Hoge v. Eaton, 135 Fed. Rep. 411, Judge Hallett has directly rejected the doctrine of riparian rights, inherited from the English common law, in favor of the doctrine of prior appropriation, which is a fundamental legal necessity in countries where irrigation is required. He has decided that the right to divert running water for irrigation is not affected by political divisions and is the same in all states through which the stream so diverted may pass. In this case he rules that an appropriation of water for irrigation in Wyoming from a stream rising in Colorado is valid against a subsequent appropriation in the latter state for the same purpose. It is hardly possible for a resident of the eastern states to realize the importance of such a decision in the west, where the development of the country depends in no small measure on the recognition of this doctrine.

Experimental Work With Wells at Battle Creek.

Some interesting investigations of the yield of wells were undertaken a Battle Creek, Mich., some time ago by Mr. W. W. Brigden, city engineer. They showed that the ground water level was lowered at a distance of a mile from the experimental wells when pumped continuously for ten days at a rate of 5,000,000 gal. per 24 hours. The depression was very flat. At a distance of ¼ mile it did not exceed 3 ft., at ½ mile it was less than ½ ft., and at a mile it was just perceptible. The water was naturally under pressure, with a nearly impervious stratum 40 or 60 ft. thick above, and three of the wells flowed 2,000,000 gal. per day without pumping. The experiments were described by Mr. Brigden at the convention of the Michigan Engineering Society, and from his paper as published in its "Proceedings" the following notes are taken:

When the investigation of a well supply for Battle Creek was determined upon, it was concluded to have the work done by a local well contractor at a price per foot, the city to furnish the pipe and other similar material. A single 6-in. well less than 100 ft. deep had been put down late in 1903, and flowed 280 gal. per minute; and could be pumped up to above 500 gal. per minute without lowering the water more than about 10 ft. from the surface.

As the volume and pressure of the water had increased considerably in the lower portion of the well, it was determined to put down a larger one and drill the same to a greater depth. The size chosen was 8 in. diameter, and the well was drilled to a depth of 129 ft. It passed through about 10 ft. of fine sand; then through 60 ft. of Marshall sandstone rock with a fine grain, and at that point reached the water-bearing stratum. The drilling was still continued in the Marshall sandstone rock to a further depth of 70 ft. In this portion of the well openings were found where the drill met little resistance, the openings ranging from 2 in. to 3 ft. For the last 4 ft. the material was fine sand or quicksand with a small amount of clay, but it is probable that this material only goes a short distance below the bottom of the well. This well flowed 600,000 gal. per day, and could be pumped at a rate of about 1,500,000 gal. per day, the water standing 20 to 25 ft. below the surface of the ground at the time of maximum pumping.

The third well was put down through the following material: 30 ft. of fine wet sand, ordinarily called quicksand; 40 ft. of nearly impervious Marshall sandstone rock; 54 ft. of open sandrock with the finest flow of water encountered, and 5 ft. into quicksand like that in the well previously mentioned.

The fourth well was in the same fine sand heretofore mentioned to a depth of 35 ft. From this point the Marshall sandstone rock was passed through to a depth of about 114 ft., about 90 ft of the distance being in a good water-bearing stratum. Below this rock the same quicksand heretofore mentioned was penetrated to a depth of 5 ft.

The fifth well reached the rock at 11 ft. from the surface, and continued in the same to a farther depth of 105 ft., the water-bearing stratum not being entered until at a depth of about 60 ft from the surface. Below the rock quicksand was penetrated to a depth of 4 ft. This well was drilled while the other four walls were being tested, and no test of its capacity has been made. Water rises to a height of nearly 2 ft. above the surface of the ground, and it is probable this well would equal in capacity the second one.

The test of the first four wells was made with two centrifugal pumps, one with a capacity of 1,000 gal. per minute and the other with a much larger capacity, but owing to the latter having been considerably worn, and the well on which it was placed not flowing as freely as the other, it never pumped anywhere near its rated capacity. The first mentioned pump was nearly new and in fine condition. It frequently ran at considerably above its rated capacity and often discharged over 2,000,000 gal. of water per day by actual weir measurement. There was no guessing at any of the discharges, they being all measured by weirs carefully made and well located, readings being taken from five to ten times per day and sometimes oftener. The fourth well was pumped with two 8½ x 10 x 10-in. low-lift steam pumps A single and larger steam pump was used on the first well. Four traction engines were used to furnish steam, being belted to the centrifugal pumps and piped to the steam pumps.

The total cost of well and testing, including five 2-in. wells put down late in 1903 to a depth of about 75 ft., was about $3,300. The cost of putting down the wells was largely increased owing to the difficulty of getting through the fine wet sand and the upper layers of rock, as the sand came into the well tubes so fast as to require constant sand-pumping above the rock, and after the rock was entered, there was in most cases so free a movement of fine sand into the well tube that but 1 to 6 in. could be gained at each drilling, while the sand-pump had to be lowered from two to four times to get out all the sand. It was necessary to reduce some large wells to a smaller size after they were some distance in the rock, and this occurred in several cases even after the precaution of first driving 2-in. wells. In one case where the surface layer of sand is but 20 ft. thick, an 8-in. tube was driven into the rock 24 ft. and the sand still came in very freely, almost no progress being made.

At this point the drill was suddenly caught by the running sand and held so firmly it could not be extricated. Several days were spent in attempts to get it out and finally resulted in the drill proper being left in the well; but the long iron stem and rope were saved, the drill being dynamited from the stem by a fortunate location of the charge. A movement of 50 ft. was made and resulted in a similar failure, although the drill was saved by hauling on the rope instantly until the pull lifted the Austin rock drilling machine at the end farthest from the well nearly a foot from the ground. Later an 8-in. well was started in the near vicinity, where the sand was 30 ft. deep, but the 8-in. pipe could not be driven far enough into the sand rock, and a 6-in. pipe was put inside the 8-in. and a good well obtained in this manner. To find a proper place to locate this well, six 2-in. wells were put down in addition to the two 8-in. ones before mentioned. In no other case, however, did it take more than one 2-in. trial well to locate properly. All these wells were paid for by the foot and they added materially to the cost.

The pumping of 5,000,000 gal. per day for ten days does not give surety that all conditions have been met, although the best evidence available was probably obtained without very large expense. The weather was unusually dry at the time, so much so that streams and wells in the vicinity were very low, and some of them went entirely dry; whether this was entirely due to the dry weather or partly to the pumping may be in doubt, but certainly was not in all cases; for a few of the shallow wells within one-half mile went dry when the city wells were allowed to flow or were pumped and water would appear again in the private well within a few days after shutting off the flow. It is not customary in Michigan to make a determination of the iron contained in city water, but the Massachusetts State Board of Health invariably does this in the case of a ground water supply. It is fortunate for Battle Creek that it was determined to investigate this matter of iron from the start, for otherwise we might have made so serious a mistake as to have endangered the success of this or any well project. The first analysis showed 0.02 part of iron per million; the second, 0.03 part; a third, 0.14 part; the fourth, 0.28 part; the fifth, 0.25 for one well and 0.40 for another; the sixth, taken during the latter part of the ten days' test, showed 2.5 parts in the case of one well and 4 parts in another. Crockeryware placed under the flow of these wells, whether the flow was large or small, showed serious discoloration, although the water placed in bottles and allowed to stand, either corked or uncorked, would go without precipitation for months, while in other cities a dark, brown-colored precipitation would show at the bottom of the bottle in one day, or even less.

Hydrated Lime.

The rapid increase in the uses of hydrated lime since its first introduction a few years ago is not at all surprising. The tests of its strength alone or mixed with cement have proved its usefulness within wide limits, while the mason has found the addition of hydrated lime to cement results in a mortar that is worked with greater ease than a full cement mortar. Its form is such that it is as easily shipped and handled as cement, and it needs none of the troublesome slaking that is required to prepare lump lime for use.

The manufacture of hydrated lime is not a difficult matter, depending for success more on an intelligent use of carefully designed machinery than on any trade secrets. The lump lime is first broken in a rotary crusher or its equivalent into pieces not larger than 1 in. in size. This is done to reduce the material to a fairly uniform size and thus secure uniform slaking, for large lumps slake much more slowly than small ones. Many makers object to grinding the lime on the score that unburned and clinkered material is passed into the product in this way and makes the hydrate gritty.

The crushed lime is then hydrated. In the typical plant under consideration this is done in a circular pan which is slowly rotated about a vertical axis by gears. The pan rests on ball bearings and requires but little power to move it. The lime covers the bottom of the pan to a depth of about 7 in., and as the machine revolves the contents are turned over by a gang of plows. While this is done the lime is sprinkled with a spray of water, and the success of the hydration depends largely on the way this is done. The addition of the water slakes the lime, the plows turn it over so that all parts are thoroughly treated, and the heat evolved finally drives off the surplus water, leaving the finished hydrate in the form of an impalpable powder having a temperature that may run as high as 200°.

When the material has cooled sufficiently it is discharged through an opening in the bottom of the pan into the bin of the screening device. It is liable to contain unburned particles, clinker, sand and other matter which detract from its value, and these are usually removed by inclined screens or air separators. Hydrated lime is screened to a fineness of 40 to 200 mesh by either of these methods, and then passes into the storage bins.

Gasoline Motor Cars have been ordered by the Chicago & Alton R. R. for suburban service, as an experimental substitute for some of the light trains now hauled by steam locomotives. The company is running these trains between Pontiac and Bloomington and between Springfield and Girard as frequently and at the same rates of fare as electric competitors.

Use of Railroad Rail as a Rod Support in Leveling.

In August, 1903, Mr. Ralph D. Libby, of the U. S. Coast and Geodetic Survey, found on the line of precise levels from Ogden to Pocatello that a discrepancy of the minus sign was rapidly accumulating. The average rate of accumulation was —0.67 millimeter per kilometer for the first 71 kilometers of the line during the period Aug. 5-26. Previous experience indicated that such a result is in general due to systematic settling of rod supports. Mr. Libby therefore determined to try the effect of placing the foot of the rod on a spot marked in red on the top of the railroad rail. This method of support had been, unknown to Mr. Libby, tried years before with complete success on the precise level line, St. Paul to Duluth, Minn., by Mr. James A. Paige. He used the rail for the rod support during all the leveling done by him in September and ending at Pocatello. Up to the time that this experiment was commenced the rods had been supported on foot pins. Soon after Mr. Harold D. King, in charge of another Survey party was informed of the experiment; he also began using the railroad rails instead of the foot pins as rod supports. In their reports both chiefs of party claim that the use of the rails in place of the foot pins saved enough time to enable the party to run one or two miles more of single line per working day than they otherwise would have done. The saving results from the fact that, as the point on the rail is recoverable at any time, the rear rodman may come forward at once when the observations upon his rod are completed; whereas if a foot pin or foot plate is used, he must wait until the recorder has made certain that the observations check properly and he has received a signal to that effect before pulling up the pin or plate. Mr. Libby reported that the accuracy was also greatly increased. Mr. King reported that the accuracy was not increased. A careful examination of the office computation brings out the following corroboration of these reports, which is given in Mr .John F. Hayford's description of the precise leveling in Wyoming and Idaho, prepared for the 1904 report of the Superintendent of the Survey.

During the period Aug. 5-26 Mr. Libby completed 85 kilometers of line, the average speed being 117 kilometers per month, using foot pins. During the period Sept. 1-16 he completed 70 kilometers of line, the average speed being 131 kilometers per month, using the top of the rail as a rod support. During the period Sept. 17-28, while the party was leveling between McCammon and Pocatello, it was not allowed to use velocipede cars on account of possible interference with the electric block signaling system there used. This made the leveling much slower than it otherwise would have been. Nevertheless, the average rate of progress was 87 kilometers per month, or a total of 35 kilometers in the period named, using the rail as a rod support. As to accuracy, it may be noted that for the continuous line composed of sections run for the first time during the period Aug. 5-26, when foot pins were being used, the percentage run more than twice was 22; and similarly for the period Sept. 1-28 this percentage was 13. The rate of accumulation of the discrepancy between the forward and backward lines was, during the first of these periods, —41.6 millimeters on 75.6 kilometers, or —0.55 millimeter per kilometer; and during the second period, +18.9 millimeters on 98.8 kilometers, or +0.19 millimeter per kilometer. The probable error of a single kilometer of completed leveling for the first of these periods was ± 0.77 millimeter and for the second ± 0.74 millimeter.

Mr. King stated that he began using the rail as a rod support in September, but did not name the exact date. For the purpose of investigating the effect of the change a comparison is here made between the period Aug. 4-Sept. 15 and the remainder of the season, Sept. 16-Oct. 24. During the first period Mr. King completed 174 kilometers of line, the average speed being 124 kilometers per month; and during the second period 189 kilometers, the average speed being 145 kilometers per month. For the continuous line composed of sections run for the first time during the first-named period, the percentage run more than twice was 17, and similarly for the second period it was 11. The rate of accumulation of discrepancy between the forward and backward lines during the first of these periods was —32.2 millimeters on 161 kilometers, or —0.20 millimeter per kilometer; and during the second period —33.6 millimeters on 180.7 kilometers, or —0.19 millimeter per kilometer. It is worthy of note in this connection that the accumulated discrepancy on the last 157.7 kilometers of the line, all run after Sept. 23, 1903, was only —7.8 millimeters, or only —0.05 millimeter per kilometer. The probable error of a single kilometer of completed leveling for the first of these periods was ± 0.65 millimeter and for the second period ± 0.70 millimeter.

The most prominent effect of changing from the foot pins to the rail for the support of the rods was to change the rate of accumulation of discrepancy between the forward and the backward lines. This is a clear confirmation of the theory that the accumulated discrepancy is due mainly to systematic rising or settling of rod supports. This theory is based upon the frequently observed fact that when a change is made in the method of rod support, or in the habits of the rodman, a change is apt to take place in the rate of accumulation of discrepancy between the forward and backward lines.

The evidence shows clearly that the use of the rail for the rod support increased both the speed and the accuracy of the leveling. Corresponding credit is due Mr. Libby for introducing this practice.

Two uncertainties in connection with this method of rod support will occur to any one who considers it carefully, namely, the uncertainty as to whether the rodman holds the foot of the rod for both foresight and backsight on precisely the same point on the slightly rounding and sometimes inclined surface of the top of the rail, and the uncertainty as to the recovery by the rail of its former elevation after a train has passed over it.

The first of these uncertainties is very small, provided the rodman is careful. No difficulty was found in marking the exact spot on the rail which was used in such a way, with chalk or kiel, that the mark was recoverable, even after a train had passed over it.

Direct observations have indicated that as a rule the rail rises to sensibly its former elevation quickly after a train passes. Doubtless there are exceptional cases. The best proof available that such cases are comparatively rare for the condition under which the rail was used as a rod support, and that the systematic permanent settling of the rail caused by the passage of the train is exceedingly small, is furnished by the above comparison of the accuracy of the leveling by each party before and after beginning the use of the rail as a rod support. A systematic settling of the rod supports tends to produce an accumulated discrepancy with a minus sign. This sign is found in Mr. King's leveling on the rail, but during Mr. Libby's leveling on the rail the accumulated discrepancy had a plus sign, indicating a systematic rising of the rod supports between each foresight and the corresponding backsight. The foot pins were carried along with each party during the progress of the leveling and were used whenever a train was known to be approaching or when there were special reasons for supposing that the track was not in as stable a condition as usual. The results are not subject therefore to the possible uncertainty arising from the action of every train.

Book Notes.

The "Manual on Sanitation" written by Dr. Geo. M. Price has reached a second edition. Although it has been improved in many respects, it still falls short of being a "manual of theoretical and practical sanitation." On the other hand it gives a good idea of the character of the sanitary inspection done in New York City. It will unquestionably be a useful guide for inspectors. (New York, John Wiley & Sons; cloth, 12mo, $1.50.)

The "Proceedings" of the eleventh annual convention of the American Society of Municipal Improvements form a volume of 170 pages, this small size being due to the fact that the usual importance of the Society's meetings was diminished last year by the attractions of the International Engineering Congress, held at the same time. Nevertheless the volume contains some valuable papers and discussions on pavements, waterworks, sewerage systems and other features of municipal engineering. (Brooklyn. Geo. W. Tillson, Secy., Municipal Building; cloth, 8vo, $1.00.)

An interesting book for explorers and engineers engaged on reconnaisance surveys has been written by Mr. Thos. Ferguson on "Automatic Surveying Instruments." It explains the construction and use of the pedograph, an automatic route tracer for pedestrians; the cyclograph, an automatic route tracer for vehicles; and the hodograph, for the self-registration of courses and distances on water. The fact that Dr. Hammer, of Stuttgart, contributes an introductory chapter of commendation for these instruments is proof of their value. (London, John Bale, Sons & Danielson, 83 Great Titchfield St.; cloth, 12mo, 4s.)

The second edition of Mr. James A. Moyer's "Descriptive Geometry" appears within about a year of the first, which is a good indication of the value of the book. It is wholly unlike the standard German treatises on the subject, being a handbook for classes which will use their knowledge in practical engineering work. The author states that it is not intended for self-instruction, but anybody of ordinary intelligence should have no difficulty in going through the book without a teacher. It gives all the information concerning the subject that an engineer is likely to require. (New York, John Wiley & Sons, cloth, 8vo, $2.00.)

A book which will be very helpful to many students of thermodynamics is Mr. Charles W. Berry's "Temperature-Entropy Diagram." The author speaks of entropy as a ghostly quantity, and there is no question but that it is a bogie to most people. Nevertheless nobody can hope to keep in touch with the scientific research which is advancing the working lines of steam engineering who does not have a good grasp of the temperature-entropy diagram. This explanation of it and its applications is not easy reading, even to those with some knowledge of thermodynamics, but it is well worth study. (New York, John Wiley & Sons; cloth, 12mo, $1.25.)

Now that the Assuan dam has again become so prominent in engineering affairs, a good many readers will find Sir William Willcocks' "Assnan Reservoir and Lake Moeris" a particularly interesting book. The plans for the dam at the present site were largely due to this eminent engineer, whose preliminary report on the work was presented somewhat over ten years ago. In it he recommended the construction of a dam with numerous sluices, and this type was adopted. The purpose of the sluices is to discharge the lower part of the impounded water during floods and thus prevent silting. The further utilization of the Nile water by storage in Lake Moeris is a subject of equal interest with the raising of the height of the Assuan dam. There has been much debate on the project, and for this reason the clear exposition of it by its author in this book is very interesting. (New York, Spon & Chamberlain; cloth, 8vo.)

Three essays that no engineer should fail to read are published in Mr. James Douglas' "Untechnical Addresses on Technical Subjects." The first is on the characteristics and conditions of the technical progress of the nineteenth century, the second on the development of American mining and metallurgy, and the third on wastes in mining and metallurgy. Not since the appearance of Morison's "New Era" has a book appeared so representative of the true spirit of engineering or so encouraging to those who follow it. An extract will indicate its style: "Horror at mastering such an appalling volume of knowledge as would have to be acquired if all the facts, phenomena and theories of all these sciences had to be packed into the brain of a metallurgist and miner might well deter any of us from undertaking the task of qualifying ourselves for creditably filling the humblest place in the ranks of the profession. The utmost that we can do is to familiarize ourselves with the main principles of the sciences I have referred to, so that when we come to occupy prominent positions in one corner or another of the industrial world, we will at least be able to map out the lines on which work is to be done and be able to judge whether the technical specialists whom we employ are fit to do the work which we have assigned them." (New York, John Wiley & Sons; cloth, 16mo., $1.00.)

Letters to the Editor.

Reinforced Concrete Floors.

Sir: In my article, "Design of Reinforced Concrete Floors," published in the issue of 15th inst., I find that the sentence, "An easy investigation will show that if 16 sq. in. of concrete is placed above the steel." This should read, "will show that if 16 sq. in. of concrete for each ten of stress in the reinforcing bars is placed above the steel." I wish you would run a note explaining this in your paper, as the omission changes the meaning very much, and makes it impossible to understand the following line.

Yours truly, H. Alexis d'O. Saurbrey.
Brooklyn, April 16.

Run-of-Crusher Concrete.

Sir: The feature of special interest in the enclosed photograph of a concrete dam is the fact that although this dam was built in 1898 the stone used for concrete was the run of the crusher. Field stone and slate rock in approximately equal amounts were used, being the most available material. The concrete is today in practically as good condition as when completed. The writer in adopting this expedient was unable at that time to find any precedent therefor. This method of making concrete is now in general use on this class of work. The use of the run of the crusher was first brought prominently to the attention of the public a few years ago in a published description of the work on the Buffalo breakwater. It is to be presumed that other engineers had prior to that time adopted similar methods, although if so such cases have not come to my attention. The dam impounds water in the storage reservoir at Montour Falls, New York.

Yours truly, Alexander Potter.
New York, April 14.

Forced Draft Pressures.

Sir: In "Notes and Comments" of the April 15 issue of The Record, an article appeared which read in part as follows: "As a rule ¾ to 1¼ in. is an ample pressure in the ashpit, yet 5 in. or more is sometimes used. This is generally due to the selection of a fan too small for its work; in order to secure the desired volume of air, the fan is run above its proper speed, thus producing the excessive pressure."

I agree thoroughly with your statement that, for ordinary conditions, 5 in. in the ashpit is too much draft; but your statement as to the usual reason for this excessive draft does not seem exactly correct. I take your statement to mean that a small fan operating at a high speed, and supplying air to a battery of boilers, would create, in the ashpit of any certain boiler, a greater static pressure than a larger fan supplying the same volume of air and operating at a lower speed. The pressure in the ashpit would, in fact, be the same in both cases provided the thickness of fire remained the same.

The velocity pressure would, of course, be higher with the smaller fan, but this no longer exists after the air has lost its velocity at entering the plenum under the grate. It is easily possible that an excessive static pressure might be created at the discharge of the small fan on account of the delivery duct being too small and offering too great a resistance to the passing air, but under those conditions a portion of the pressure would be lost in friction before it reached the ashpit.

Concrete Dam at Montour Falls, N. Y.

Yours truly, J. F. Musselman, Jr.

[The pressure which may be maintained within a closed space is not only dependent upon the pressure created by the fan itself, but also upon the relation between the capacity area of that fan and the free area for escape of air through the grates, etc. The case may be readily compared to that of a boiler which will hold its steam pressure until the area of outlet for escape of steam becomes excessive. Although the air delivered to the ashpit substantially loses its velocity and the pressure becomes static, it is true that this will in turn produce velocity through the fuel proportional to this pressure, which will be maintained by the fan until its capacity is exceeded.]

Ventilation in Engine and Boiler Rooms.

Sir: The importance of adequate ventilation in isolated plants is often unrealized by designers and owners, the result being an increase in the cost of operation difficult to measure but none the less real. It is surprising that in many cases so much attention is paid to specifying and purchasing efficient machinery and so little to raising the standards of personal convenience and comfort which make for economy in the use of brain and muscle. Doubtless it is true that the isolated plant is peculiarly handicapped in the matter of ventilation because of its frequent location in a sunless and airless sub-basement; but it is equally true that a judicious use of the motor-driven blower—sometimes a single fan motor—will work wonders in the atmosphere of the most unpromising engine and boiler rooms. A 5-h.p. outfit at the outside ought to be sufficient for most cases of single room ventilation, but the cost of operating a larger equipment may well be worth the improved ventilation secured through an entire sub-basement by the installation of a well considered system of ducts and outlets.

This whole matter of ventilation is at present difficult to approach on any but the experimental side. It is very hard to predict the outcome of installing a certain size of equipment in an untried situation, basing one's estimate upon other installations which may outwardly seem to be similar in conditions, but which in reality are not. Probably the best plan is to experiment a little with the equipment that is available, unless the owner is sufficiently appreciative of the situation to enlist the services of a ventilation engineer. One thing that can be done, however, is to see to it that all exposed steam and hot water piping is properly lagged; that the fire doors of the boilers are closed as much of the time as possible, and that the electrical equipment is not overloaded to the point where it does duty as a radiator. In some basements the windows can be opened with profit to create a circulation of air.

Of course, all heat which emanates from steam and electrical equipment, other than that needed to keep the room comfortably warm, is wasted energy. It is not possible to avoid such losses entirely, so that in warm weather practically every engine and boiler room is subjected to superfluous heat. That such a room is hot is not necessarily a sign that the plant is poorly operated, but it does generally mean that the remedy of the fan motor has not been thoroughly tested. It amounts to little to simply stir up the devitalized air of a room by an electric fan. What is needed is a proper entrance of the air supply and a suitable exit for the discharge. Given these two and a fan motor, the isolated plant in the coming hot season can be made a more comfortable and consequently a more efficient place of work.

Yours truly, S. K. Howard.

A Noted Paving-Street Railway Case was settled by the U. S. Supreme Court recently, when a decision was rendered in favor of the Worcester Consolidated Street Ry. Co. against the City of Worcester. From time to time, prior to 1898, the company agreed, under the terms of the State laws, to pave and maintain a part or all of the streets through which it extended its tracks. In that year the State tax laws were somewhat changed, and the railway companies were relieved of the maintenance of the pavements, provided they accepted certain other obligations. The Worcester railway did so and has since refused to keep the pavements in repair. The city brought five actions against the company to compel it to live up to its original contracts. The Supreme Court decides that the city is "simply a political sub-division of the State," and could be abolished by the Legislature. It can own private property, but the right to demand of the railway the continuance of the repair of pavements is not "property." The original contract provided merely a means of collecting from the company part or all the expense of maintaining pavements in some streets. "That method of collection," the court rules, "did not become an absolute property right in favor of the city, as against the right of the Legislature to alter or abolish it, or to substitute some other method with the consent of the company."

CURRENT NEWS SUPPLEMENT

APRIL 29, 1905.

DIRECTORY OF NATIONAL TECHNICAL SOCIETIES.

American Society of Civil Engineers. Secretary, Chas. Warren Hunt, 220 West 57th St., New York. Annual convention, Cleveland, June 20-23. Next meeting, May 3, papers on round-house framing and on foundations.

American Society of Mechanical Engineers. Secretary, F. R. Hutton, 12 West 31st St., New York.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, 95 Liberty St., New York. Annual convention, Asheville, N. C., June 19-23. Next meeting, May 16, papers on relays, circuit-breakers and oil-switches, and the proper limit of duplication to secure reliability of service.

American Institute of Mining Engineers. Secretary, R. W. Raymond, 99 John St., New York.

American Institute of Architects. Secretary, Glenn Brown, Washington, D. C.

Association of Engineering Societies. Secretary, John C. Trautwine, Jr., 257 South Fourth St., Philadelphia, Pa.

American Society of Heating and Ventilating Engineers. Secretary, W. M. Mackay, 235 Water St., New York.

Canadian Society of Civil Engineers. Secretary, Clement H. McLeod, 877 Dorchester St. Montreal.

Society for the Promotion of Engineering Education. Secretary, Prof. M. S. Ketchum, University of Colorado, Boulder, Colo.

American Society for Testing Materials. Secretary, Prof. Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

American Society of Municipal Improvements. Secretary, George W. Tillson, Room 12, Municipal Building, Brooklyn, N. Y.

Association of Railway Superintendents of Bridges and Buildings. Secretary, S. F. Paterson, Concord, N. H.

American Railway Engineering and Maintenance of Way Association. Secretary, L. C. Fritch, 1562 Monadnock Block, Chicago.

American Water-Works Association. Secretary, J. M. Diven, Charleston, S. C. Annual convention at West Baden, Ind., May 8 to 12.

American Foundrymen's Association. Secretary, Richard Moldenke, P. O. Box 432, New York.

Engine Builders' Association of the United States. Secretary, J. L. Lyle, 39 Cortlandt St., New York.

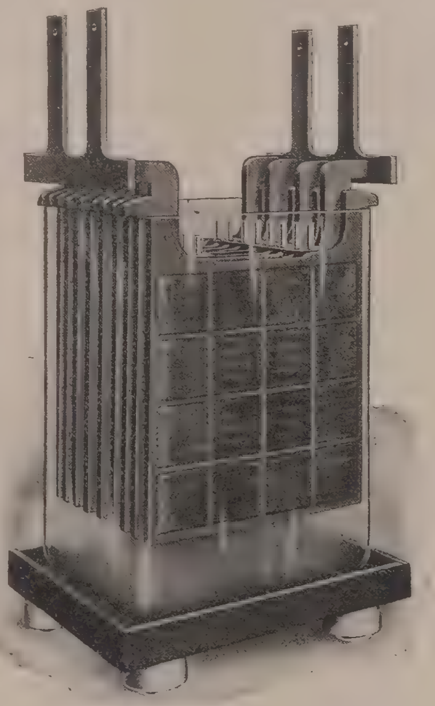
A NEW STORAGE BATTERY.

As the result of several years' work on the part of Mr. Joseph Bijur, of New York, assisted by Dr. J. S. C. Wells, of Columbia University, a new form of storage battery plate has been produced which differs radically from earlier types. This design has a rigid structure to ensure freedom from distortion, good acid diffusion with the active material incapable of displacement, high specific capacity, high rates of charge and discharge, high efficiency, good regulation and freedom from "sulphation," buckling and other destructive action, save ordinary wear and tear. These characteristics are obtained by using a plate made up of small, finely subdivided structures each free to expand unrestrainedly and firmly welded to a strong supporting and conducting grid.

The active portions decided on as most advantageous could not be produced at commercial cost by any known method, whereupon Mr. Bijur set to work to produce these crudely, following this up by devising automatic machinery by which these parts are now made with great uniformity and at low cost. By no method of metal working then existing was it possible commercially to weld together two elements, of which one was a heavy solid and the other consisted of very fine thin parts. It was necessary to devise a new method of metal welding and a new line of machinery for carrying on the work.

The requisite quality and uniformity of oxide next received attention with the result that, to secure the desired effects, a new process of formation was devised by which great toughness, porosity and other desirable qualities could be imparted to the oxide layer, the whole process being perfectly reliable and at all times under the control of the operator.

The Bijur plates are composed of multiples of pure lead structures in the shape of gratings or "grills." These are welded to a stiff frame of lead and antimony. The frame merges into the grill without joint. At each end of the grill, a space is provided for its elongation by expansion, and provision is made for expansion sidewise. The result is a plate having the stiffness, strength and inoxidizable support of the alloy grid, rigidly held active parts, yet complete provision for their expansion without the setting up of any strains that can produce buckling. When in the untreated metallic state the grills are very open structures, having a large number of component ribbons running in the vertical direction, supported by heavier cross members running horizontally, which serve as conductors and give lateral stiffness. During the formation process, part of the metallic lead is converted into oxide, which, by reason of the large increase in volume, nearly fills the openings. The ribbons on the positive elements have a large amount of metal left as a reserve for the oxidation which is attendant on the normal action of every storage battery. When the oxide is formed in the rectangular cells, it assumes a slightly elliptical shape, which, expanding into the rectangular containing space, produces a locking in that is so positive that nothing short of destruction of the plate can dislodge it. At the same time, even when the oxidization is carried to the point of apparently completely filling the cells, the tendency of the ellipse to grow larger along both its axes, insures the presence of a minute slot through the centre of the oxide mass. which allows the flow of electrolyte to take place freely through it.



THE BIJUR HIGH-DUTY STORAGE BATTERY.

The makers claim that owing to the rapid acid diffusion full charge may be given the batteries at a voltage of 2.4 to 2.5 volts instead of 2.7 volts per cell as is usually required. This low charging voltage results in increase of efficiency, and reduces the size of boosters required to charge. Since storage battery plates can be calculated out scientifically and then constructed in exact accordance with the design, the work of Mr. Bijur places the manufacture of storage batteries on the same basis as that of dynamo-electric machinery. These processes permit of any suitable forms of active parts and supporting frame-work being united into one integral structure at a low cost of production, and without the introduction of any foreign substances. Such being the case, an improvement in storage batteries may be expected similar to that which took place in dynamo construction after the laws of magnetic circuit and magnetic constants had been explained by Hopkinson, and applied by the engineering fraternity.

The General Storage Battery Co., which is now putting elements of this type on the market under the name of the Bijur "High Duty" battery, has recently equipped a factory at Boonton, N. J., with special automatic machinery, for their cheap and rapid production. The company has also developed a new and complete line of automatic regulating boosters, end cell switches, and other auxiliary apparatus for all classes of central station work and power plants. All of these devices differ as radically from the present known types, as does the Bijur battery from the conventional storage battery electrodes.

CONVENTION OF THE AMERICAN WATER-WORKS ASSOCIATION.

The American Water-Works Association will be twenty-five years old at the next convention, which will be held at West Baden, Ind., and it is proposed to make the meetings unusually interesting in celebration of a quarter-century's career. The convention will last from May 8 to 14, inclusive, and will be held at the West Baden Hotel, which is large enough to accommodate, without crowding, all who attend.

The following papers are promised: "The Tokyo Water-Works," Y. Nakajama; "A Pictorial Appeal," H. F. Dunham; "Notes on the Density of Pure Water," M. L. Holman; "Sundry Notes on Deep Seated Water," Prof. W. P. Mason; "Concerning Water Softening for Municipal Plants," George W. Fuller; "Some Experiments with Copper Sulphate," James M. Caird; "The d'Auria Pumping Engine"; "Some Additional Data on Pipe Coating," F. W. Cappelen; "Turbine Engines for Water-Works," by Dabney H. Maury; "Water Rates, both Fire and Domestic," by S. J. Rosamond; "Commercial Pumping Engines," Charles A. Hague; "Books for the Water-Works Office," Moses N. Baker. Several more papers are expected and there will be various committee reports. Some important changes in the Constitution are also due for discussion.

Excellent facilities for exhibits have been provided, and it is expected that the display of water-works specialties will be unusually complete this year. Information as to space can be obtained from Mr. Fred Mueller, Decatur, Ill.

The entertainment committee has given special attention to the social functions for the ladies attending the convention, which has not been a difficult task in view of the many attractions of this famous resort. Special rates have been granted by the railroads to those who will be present at the convention. Further information can be obtained from the Secretary, Mr. J. M. Diven, Charleston, S. C.

WESTINGHOUSE CHANGES IN NEW YORK.

Westinghouse interests will occupy all but a small part of the nineteenth and twentieth floors of the new Trinity Building at 111 Broadway, New York, after May 1. The executive offices of the Westinghouse Electric & Manufacturing Co., which have for nearly twenty years been in the Equitable Life Building, will be on the nineteenth floor of the new building, and the Eastern sales offices of the Westinghouse Air Brake Co. and the Westinghouse Traction Brake Co. will occupy a large part of the twentieth floor. The law offices of Hunt, Hill & Betts, which have been for several years in the Equitable Life Building, will be on the twentieth floor of the new building, and the remaining part of the floor has been sublet to an engineering company.

The United States Electric Light Co., which was absorbed by the Westinghouse Electric Co. shortly after the organization of the latter company, opened offices in the Equitable Life Building in 1878, and the old building has been more or less a Westinghouse headquarters in New York for the past generation, and the New York office of Mr. George Westinghouse. The new offices in the Trinity Building will be more commodious, to provide for the growth of the working staff in the treasury and other departments.

The New York sales offices of the Westinghouse Electric Co. will remain in the Hanover Bank Building, at Pine and Nassau Sts., without changes, and the New York office of the Westinghouse Companies' Publishing Department, formerly at 10 Bridge St., will be connected with them. The export offices of the electric company will continue at the same address, under the management of Mr. Maurice Coster, recently appointed to succeed Mr. F. B. H. Paine, and the office of Mr. Charles S. Powell, the new general agent of the electric company, will be connected with the sales and export offices. Mr. Coster and Mr. Powell have arrived from Paris and from London to take up their new duties, after long terms of successful Westinghouse service abroad.

Mr. Coster, who has acted as sales manager of the Societé Anonyme Westinghouse since the spring of 1899, has had a broad experience in domestic and foreign markets. His Westinghouse connection began in 1888, in Pittsburg, and later he acted as manager of the Chicago office of the electric company. His work for the French Westinghouse Co., which manufactures nearly all forms of Westinghouse products—railway appliances, prime movers and electrical apparatus—involved several branches of engineering, and he will act as export manager in New York for the Westinghouse Machine Co. as well as for the electric company. He has for many years been a full member of the national electrical and mechanical engineering societies.

Mr. Powell returns to America after two years and a half as assistant manager of the British Westinghouse Electric & Manufacturing Co., in which his duties brought him into contact with all the important plans for the electrification of England's traction systems and railroad terminals. Prior to his departure for England in December, 1902, Mr. Powell had acted as manager of the Cleveland office of the Westinghouse Electric & Manufacturing Co., with which he began work in 1893.

BUSINESS NOTES.

The Warren Asphalt Paving Co., Cambridge, Mass., has recently been incorporated with Geo. C. Warren as president, Geo. H. Perkins secretary and Alfred H. Johnson treasurer. The company carries on the business of the partnership formerly existing under the same name, and will furnish refined asphalt, asphalt paving plants and expert advice to paving contractors. It will also take paving contracts itself.

The W. N. Sauer Co., plumbing contractors, have removed the main offices to the Bessemer Bldg., Pittsburg. The company makes a specialty of the work in large buildings, industrial establishments and the like, where technical knowledge as well as good workmanship is necessary.

Recent power-plant orders taken by the Allis-Chalmers Co. include a 600-kw. a.-c. Bullock generator for the Fort Worth plant of Swift & Co., a 30 x 48-in. heavy-duty Reynolds-Corliss engine for the Bethlehem Steel Co., two 24 x 48-in. Reynolds-Corliss engines for the Fred W. Wolf Co., Chicago, five complete units of 1500 kw. total capacity for Mandell Bros., Chicago, three sub-station equipments for the Sandusky, Norwalk & Mansfield Ry., two heavy-duty non-condensing 26 x 48-in. Reynolds-Corliss engines for Bernard F. Weber, Chicago, two 750-kw. units having Bullock generators and Reynolds-Corliss vertical engines for Walter Baker & Co., Milton, Mass., two 800-kw. generators for the new power house of the Cambria Steel Co., a complete 175-kw. electric lighting plant for the Obion Lighting Co., Obion, Tenn., and an 800-kw. Bullock generator for the American Cereal Co., Cedar Rapids.

The American Engineering Co., 612 Traction Terminal Bldg., Indianapolis, Ind., has been incorporated, with a capital of $300,000, for the handling of railroad and other construction contracts. The following officers have been elected: Chas. N. Wilson, president and general manager; J. C. Ostrup, vice-president and chief engineer; Edw. W. Barrows, secretary and treasurer; Arthur C. Neely, fiscal representative; John A. Shafer, superintendent of construction. The board of directors include, beside the officers, Ernest V. Abbott and Harrison Cale. The advisory board includes August M. Kuhn, Fletcher S. Hines, Amos K. Hollowell, Walter R. Palm and W. F. Barrows.

The Talbott-Uhl Construction Co., Logansport, Ind., has been incorporated with a capital of $50,000. The company will contract to build sewers, drains, roads, pavements and buildings. Dennis Uhl and M. A. Talbott, directors.

The First National Bank, Milwaukee, having had assigned to it two-thirds of the capital stock of the National Electric Co. to secure loans, has taken over the control of the latter company. Messrs. John I. Beggs, Charles F. Pfister, Frederick Vogel, Jr., J. H. Van Dyke, Jr., all First National Bank directors have been elected directors of the National Electric Co., replacing Pres. S. W. Watkins, chairman, F. H. Bigelow, F. C. Randall, director, vice-president and general manager, and Gordon Bigelow. Former directors A. N. McGeoch and B. T. Becker remain on the board. John I. Beggs has been elected and accepted presidency of company and will direct its affairs. The business of the company will be actively continued and all contracts promptly completed. The company's indebtedness is now being ascertained and when know a meeting of the creditors will be called to consider the best plan to protect everybody and promote the future welfare and progress of the company, which, Mr. Beggs believes, can be made successful and profitable.

PERSONAL NOTES.

Mr. R. Sterling has been elected city engineer of Wardner, Idaho.

Mr. G. P. Coleman has been reappointed city engineer of Winona, Minn.

Mr. T. G. Elbury has been re-appointed city engineer of Hutchinson, Kan.

Mr. Edwin Jerome has been elected village engineer of Fairview, Wayne County, Mich.

Mr. C. H. Mulholland, of Pittsburg, has been elected city engineer of New Castle, Pa.

Mr. J. P. Jasperson has been re-elected superintendent of the Neenah, Wis., water works.

Mr. Alonzo Kendall, of Medford, Mass., has been appointed highway engineer at Lenox, Mass.

Mr. H. S. Jones has been elected chief engineer of the Mobile, Jackson & Kansas City Ry., to succeed Mr. A. N. Bullitt.

Mr. Robert L. McAlpine has been elected city engineer and Mr. Henry S. Swingley street commissioner of Kansas City, Kan.

Mr. C. G. H. Hensall, of Newcastle-on-Tyne, has been selected by the city council of Leeds, Eng., as engineer of the water department.

Mr. Herbert J. West has been elected president of the Baltimore Ferro-Concrete Co., Baltimore, Md., to succeed Mr. David L. Hawkins.

Mr. E. C. Welch has been appointed division engineer of the Southern Kansas division of the Missouri Pacific Ry., with headquarters in Wichita, Kan.

Mr. J. F. Wade, State engineer of Montana, was elected president of the association of State engineers at its recent annual session in Cheyenne, Wyo.

Mr. Lewis J. Proctor, formerly assistant superintendent of public works of Poro Rico, has been appointed assistant commissioner of interior of Porto Rico.

Captain Sankey, R. E., retired, and Mr. G. P. Mair have formed a partnership for consulting practice, particularly in power plant design, improvement and tests. Their offices will be at 7 Dean's Yard, London.

Mr. E. D. Andrews has been appointed master mechanic of the El Paso division of the Chicago, Rock Island & Pacific Ry., with headquarters at Dalhart, Tex.

Mr. Joseph R. Geoghan, assistant engineer on the staff of the Rapid Transit R. R. Commission, has been transferred to the Department of Bridges of New York City.

Mr. R. H. Ashworth has been elected city engineer of Colorado Springs, Colo., succeeding Mr. E. W. Case, and has appointed Mr. W. H. Brenton assistant city engineer.

Mr. J. Maxwell Carrère has resigned as general manager of the Penn Allen Portland Cement Co., of Nazareth, Pa., and will establish offices at 1 Madison Ave., New York City.

Mr. W. M. Duane, superintendent of construction on the Cleveland, Cincinnati, Chicago & St. Louis Ry., has removed his office to the general offices of the company in Cincinnati.

Mr. T. Hugh Boorman, well known in the asphalt business in the Eastern States, has removed from New York to Los Angeles, where he will be engaged in promoting the use of oil asphalts.

Mr. Waldo Coulter, formerly of the engineering department of the Metropolitan Water and Sewerage Board, of Boston, Mass., has entered the U. S. Reclamation Service and has reported to Denver, Colo.

Mr. F. A. Delano, formerly general manager of the Chicago, Burlington & Quincy Ry., has been designated by Secretary Taft to serve as an expert in connection with the construction of new railroads in the Philippines.

Mr. Harry W. De Graff, of Amsterdam, N. Y., has been appointed by State Engineer Van Alstyne to be resident engineer in charge of the section of the barge canal work extending from Cranesville to Mindenville, N. Y.

Mr. Joseph M. Birmingham has been elected president and superintendent, Mr. W. E. Johnson, engineer in charge of reservoirs, and Mr. Bartholomew Dwyer, assistant superintendent of the water board of Hartford, Conn.

Mr. Charles G. Poetsch has been re-elected city engineer and Mr. Vincent J. Schoenecker has been elected commissioner of public works of Milwaukee, Wis. Mr. Poetsch is ex-officio president of the board of public works.

Mr. David Young, who is associated with Brown Bros. & Co., the New York banking house, has been retained by Mr. Alexander Brown to make a thorough examination of the physical condition of the United Railways property in Baltimore.

Mr. Walter C. Wilson, engineering aid in the U. S. Reclamation Service, has reported to Mr. F. C. Horn, constructing engineer, at Minidoka, Idaho. Mr. H. M. Morse, engineering aid, has been transferred to hydrographic work in connection with the Milk River project under the direction of Mr. C. C. Babb.

Mr. Alfred Noble's acceptance of the invitation to be one of the members of the Board of Advisory Engineers of the Isthmian Canal Commission is a welcome announcement. His previous connection with the work will give the government the benefit of exceptionally valuable advice. Herr Tincanza will represent German engineers on the Board.

Henry Bond, chairman of the operating board, American Radiator Co., will retire from active business on May 1, and Mr. William H. Hill, secretary of the operating board, will succeed him. Mr. A. A. Landon, formerly manager of Pierce Plant, Buffalo, N. Y., has been appointed superintendent of plants of the company, with headquarters at Chicago.

M. Paul Lessar, the Russian minister to China, died in Pekin, April 20. M. Lessar was formerly an engineer and achieved considerable success in the survey for the Asiatic railroads under the direction of General Skobeleff. In 1880 he explored the Turcoman country with Gen. Komaroff and later explored the whole Russian frontiers of Afghanistan and Persia.

Mr. F. H. Jones, formerly manager of the air compressor department of the International Steam Pump Co., has been appointed general sales manager of that company. Mr. Jones graduated from Cornell University with the class of 1880 and has been engaged in the manufacture and sale of pumping apparatus since then. For the last five years he has been manager of the air compressor and power pump departments and in charge of special government work for the company with which he is now connected.

Mr. Morris R. Sherrerd, engineer and superintendent of the water department of Newark, N. J., has just returned from a two months' trip to South America. Mr. Sherrerd was a member of a party of engineers and business men which was invited by the Brazilian Government to investigate the advisability of investing American capital in developing Brazilian resources and in carrying on public improvements in various cities. Mr. E. L. Corthell, of New York, and Mr. J. C. Roberts, of Niagara Falls, N. Y., were also members of the party.

Mr. W. S. Kinnear, chief engineer of the Michigan Central R. R., has been appointed assistant general manager of that road and will be in general charge of the construction of the Michigan Central tunnel under the Detroit River. Mr. Kinnear began engineering work as an axeman on the Atchison, Topeka & Santa Fé R. R. in 1883, and was engaged with various Western railroads until he entered the service of the Michigan Central in 1890 as assistant engineer of maintenance of way. He was later made supervising engineer of construction and then principal assistant engineer, from which position he was appointed to the one he has just vacated.

The chief engineer of the Reclamation Service has accepted the resignation of Mr. William Swift, engineer, effective May 1. Mr. Swift resigns to accept a position with the Isthmian Canal Commission as resident engineer. He was graduated from the Massachusetts Institute of Technology with the degree of B. S. He has been engaged in various engineering capacities since 1895 with the Boston water-works, Metropolitan water-works, Boston; Munson Steamship Line and Rapid Transit Railroad, New York City, and engineer in the Reclamation Service.

The Administrative County of London and District Electric Power Co., which is responible to a committee of the British House of Lords, is planning to construct three electric plants for generating current to supply the whole of London and those suburbs controlled by the London County Council. Each plant is to consist of six turbo-generators, each of 10,000 kw. normal, and 20,000 maximum capacity, making a maximum total of 360,000 kilowatts. As these power units are larger than any ever constructed, experts have been appointed to decide upon the practicability of units of this size. The electrical expert chosen for this important problem is Mr. C. F. L. Brown, of Brown, Boveri & Cie.

Mr. Carl Ewald Grunsky, who was recently appointed consulting engineer and adviser to the Director of the U. S. Geological Survey, was born in California, April 4, 1855. He graduated from the Stockton, Cal., High School in 1870, and afterward spent nearly six years in Stuttgart, Wurtemberg, as a student in the "Real-Schule" and in the Polytechnic Institute, from which he was graduated as civil engineer, at the head of his class in 1877. His first professional employment was as topographer with the State Engineering Department of California in 1878. He was made assistant State Engineer in charge of computations and office work relating to stream gaging in 1879, and was advanced to Chief Assistant in 1882, continuing as such till 1887. From 1887 to 1899 he was in private practice at Sacramento and in San Francisco, also serving during 1889 and 1890 as a member of the Examining Commission on Rivers and Harbors for California. In 1892-93 he was one of the engineers selected to design a sewer system for San Francisco, and served on the Sewerage Board of that city. In 1893-94 he again served the State of California as a consulting engineer to the Commissioner of Public Works, dealing with drainage and river rectification problems. The Board of Public Works, created by the new charter for San Francisco, in January, 1900, under the presidency of Col. G. H. Mendell, appointed Mr. Grunsky city engineer, which position he held until appointed Isthmian Canal Commissioner. As city engineer of San Francisco he made plans for a number of municipal improvements, including a system of main sewers, public buildings and parks for which bonds have been voted. While in private practice, he was engineer for several irrigation and drainage districts and consulting engineer for a number of cities on sewerage and water supply systems. In 1897 he contributed several water supply papers to the U. S. Geological Survey's publications, and in 1899 and 1900 was one of the experts reporting to the Agricultural Department upon irrigation and use of water from rivers in California.

CONTRACTING NEWS

OF SPECIAL INTEREST TO
CONTRACTORS, BUILDERS, ENGINEERS AND MANUFACTURERS
OF ENGINEERING AND BUILDING SUPPLIES.

WATER.

Notes Arranged Alphabetically by States.

Anaheim, Cal.—See "Power Plants, Gas and Electricity."

Santa Rosa, Cal.—L. E. Ricksecker, City Engr., writes that bonds will be issued in May for improvements as follows: $72,500 for water works, $72,500 for sewers and $50,000 for street work.

**Oakland, Cal.*—E. B. and A. L. Stone, of Oakland, are stated to have secured the contract for constructing a million-gal. reservoir for the Richmond Water Co., for $8,265.

San Diego, Cal.—It is reported that bids will be received until May 4 by the Bd. Pub. Wks. (F. H. Dixon, Secy.) for furnishing material and erecting a 2,000,000-gal. pumping plant.

Los Angeles, Cal.—The Park Comrs. are reported to have decided to construct a reservoir and install pump and gasoline engine in Griffith Park.

**Montrose, Colo.*—J. L. Atkinson, Mayor, writes that the contract for constructing a water supply system (bids opened Apr. 1) has been awarded to the American Light & Water Co., of Kansas City, Mo., for $64,980. For detail bids received for this work, see issue of the Engineering Record, Apr. 22.

La Junta, Colo.—Bids will be received May 15 by the Bd. of Directors of the Otero Irrigation Dist. (Geo. A. Kilgore, Secy.) for furnishing material and constructing gates and outlet works for a storage reservoir in said dist. Work to consist of about 300 lin. ft. reinforced concrete pipe and two 30-in. valves with fittings.

San Luis, Colo.—E. W. Case, of Colorado Springs, writes that he is engineer in charge of the proposed construction of a reservoir for the San Luis Valley Irrigation, Land & Power Co. The work will cost $150,000. No date has yet been set for the letting of the contract.

Danbury, Conn.—It is stated that this city will construct a new reservoir to furnish an additional water supply, using Boggs Pond, a lake 4 miles from city. The Legislature is stated to have authorized an issue of $200,000 bonds to complete the work.

East Hartford, Conn.—Engr. C. Henry Olmstead is stated to have completed plans, and contracts will soon be let for improvements to the reservoir. John H. Walsh, Supt. Water Wks.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Atlanta, Ga.—Local press reports state that the Bd. of Water Comrs. (Frank P. Rice, Pres.) will petition the Council for a bond issue of $400,000 to be used to lay a duplicate main from the river to the reservoir, 2 new pumps, one for the Chattahoochee station, the other for Hemphill station and to increase the size of the mains in the center of the city.

Eustis, Fla.—See "Power Plants, Gas and Electricity."

Alton, Ill.—W. A. Underwood is reported to have purchased the Alton water works and will probably make improvements to the plant at a cost of $100,000.

Frankfort, Ind.—Geo. W. Sturtevant, of Chicago, Ill., employed by City Council to investigate the water works, is reported to have recommended the rebuilding of the plant, at a cost of $87,000.

Coalgate, Ind. Ter.—Bonds to the amount of $63,000 are reported sold, to be used for the construction of water works. Engineers, Burns & McDonnell, Dwight Bldg., Kansas City, Mo.

Girard, Kan.—See "Power Plants, Gas and Electricity."

**Hoisington, Kan.*—The following are the bids opened on Apr. 20 for constructing water works: (engineers, Burns & McDonnell, Kansas City, Mo.) T. C. Brooks & Sons, Jackson, Mich., $16,318 (awarded contract); G. Jaeger, Rich Hill, Mo., $16,610; Am. Lt. & Water Co., Kansas City, Mo., $16,578; Dwyer Plb. & Heating Co., St. Paul, Minn., $18,240; Des Moines Bridge & Iron Wks., Des Moines, Ia., $21,980; F. C. Youmans, Kansas City, Mo., $19,750; W. W. Cook & Son, Junction City, $16,447, and N. S. Sherman Machy. Co., Oklahoma City, Okla. Ter., $17,700. The detail bid of T. C. Brooks & Sons, the successful bidders, is as follows: Portland concrete, per cu. yd., $7; stone masonry, per cu. yd., $7; furnishing and laying 4-in. c. i. pine, per ft., 49½ cts.; 6-in., 70 cts.; 8-in., 92 cts.; furnishing and setting hydrants, $24 ea.; furnishing and setting 4-in. valves, $11 ea.; 6-in. valves, $17 ea., and 8-in. valves, $23 ea.

Dover, Me.—The Dover and Foxcroft Water Dist. is reported to be planning to improve its reservoir on Pine St., at a probable cost of $6,000.

**Augusta, Me.*—The contract for constructing 8½ miles of 20 and 24-in. water pipe (bids opened Apr. 17) has been awarded to the Nichols-Magee Constr. Co., of Taunton, Mass.

Baltimore, Md.—The Water Bd. is reported to have decided to start a survey in the vicinity of Loch Raven, with a view to ascertaining the probable cost of improving the service and purifying the city's water supply.

Boston, Mass.—Bids will be received by the Metropolitan Water & Sewerage Bd., May 10, for improving about 30 acres of the Wachusett reservoir in West Boylston and Sterling, Mass., as advertised in The Engineering Record.

Starkville, Miss.—See "Power Plants, Gas and Electricity."

Holden, Mass.—The citizens are stated to have voted on Apr. 15 to extend the water system from Main St. near Boyden Road to Dawsonville.

**Alpena, Mich.*—The following contracts have been recommended for award in connection with the construction of water works, bids for which were opened on Mar. 25. (Engineer, John H. Blomshield, Shearer Bldg., Bay City.) For labor required in submarine construction to the Murray Co., for $23,875; for 40-in. and 16-in. riveted steel pipe in connection with same to the Bay City Boiler Co., for $8,600; pipe laying to Wm. H. Chisholm for $17,317; to American Car & Fdy. Co., at $24.70 per ton, for 1,145 tons c. i. pipe and $25.45 for 855 tons c. i. pipe and $50 per ton for specials; total $50,791; valves to C. W. Thomas for $2,952, and hydrants to Ludlow Mfg. Co., $1,145. Contracts for pumping engines not yet recommended for award.

Port Huron, Mich.—It is proposed to lay water mains as follows: 700 ft. 16 in., 8,000 ft. 10-in. and 4,000 ft. 6-in. The work will not be done by contract. H. Burton, Supt.

Melrose, Minn.—See "Power Plants, Gas and Electricity."

Marshall, Minn.—See "Power Plants, Gas and Electricity."

Montrose, Miss.—See "Power Plants, Gas and Electricity."

Nevada, Mo.—The City Council is reported to have selected Burns & McDonnell, of Kansas City, to prepare plans for water works.

Ft. Assinniboine, Mont.—Bids will be received May 18 (readvertisement) by Capt. J. B. McDonald, Constructing Q.M., U. S. A., for furnishing and installing all piping, fittings, valves, stops, etc., required; a 40-h.p. boiler, stack with breeching and roof ventilator, duplex pump, boiler-feed pump, a feed water heater with exhaust head; also about 3,050 ft. 6-in. and 650 ft. 4-in. c. i. hub and spigot water pipe.

Glasgow, Mont.—See "Power Plants, Gas and Electricity."

Wilton, N. H.—See "Sewerage and Sewage Disposal."

**Utica, N. Y.*—John Marsden, of Utica, has secured the contract for digging the trench, laying the pipe and backfilling about 13 miles of water works pipe line for the Consolidated Water Co., from a point above Hinckley towards reservoir No. 6.

Scotia, N. Y.—Engineer Lewis B. Sebring, of Schenectady, writes that bids for bonds only to the amount of $50,000 will be received on May 1. No date has yet been decided on for receiving bids for the construction. H. V. Mynderse, Village Pres.

Ogdensburg, N. Y.—The Bd. of Water Comrs. is reported to have instructed Supt. Lord to prepare an estimate of cost of extending the intake pipe from its present site to a point 1,500 ft. south along west bank of river. The Water Comrs. are also reported to be considering the feasibility and practicability of the construction of a filtration plant.

Rochester, N. Y.—It is stated that $44,000 will be expended on water main extensions this year.

Niagara Falls, N. Y.—The only bid received and opened on Apr. 18 by the Bd. of Pub. Wks. for supplying the city with water was submitted by the Niagara Falls Water Works Co. It bid for a period of 5 years and on a minimum of 6,000,000 gal. daily, 3 cts. per 1000 gal.; for 10 yrs. 2½ cts.; for 15 yrs., 2 cts.; and for 20 yrs. 1.45 cts.; to furnish 312 hydrants for 5 yrs. at $50 ea.; 10 yrs., $45 ea.; 15 yrs., $40 ea., and 20 yrs., $30 ea. The question of constructing municipal water works is also reported to be under consideration.

Oswego, N. Y.—Bids will be received by the Dept. of Water (F. W. Ormsby, Secy.) May 20 for furnishing material (with exception of c. i. pipe and special castings) necessary for the construction of an intake crib, c. i. intake 24-in. diam. in Lake Ontario and a river crossing 20-in. diam. in Oswego River, for lake water extension, as advertised in The Engineering Record.

Cohoes, N. Y.—The Secy. of the Water Bd. writes that the date of receiving bids for the pumps which were to have been opened Apr. 24 has been indefinitely postponed.

Perrysburg, O.—T. M. Franey, City Clk., writes that the citizens voted Apr. 22 to issue $30,000 bonds for the construction of water works.

Fostoria, O.—C. J. Peters, of Tiffin, has been selected to prepare plans, specifications and estimates for improving the water works by remodeling old filter bed and clear water basin for a new filter bed and a dam across Portage Creek.

Dayton, O.—Bids will be received May 10 by the Bd. Pub. Service (Wm. F. Miller, Clk.) for furnishing and delivering f. o. b. cars Dayton, 1,000 ⅝-in., 50 ¾-in., 10 1-in., 5 1½-in. and 5 2-in. water meters.

It is stated that bids will be received May 10 by the Bd. Pub. Service (Wm. F. Miller, Clk.) for furnishing and delivereing 150 tons 61in., 50 tons 8-in., 100 tons 10-in. and 50 tons 12-in. pipe with necessary special castings to correspond.

Elyria, O.—Bids will be received May 2 by Frank R. Fauver, City Aud., for enlarging, extending and improving the City Water Works, including the purchase of an additional engine for the water works station.

**Portland, Ore.*—D. D. Clarke, Engr. Water Bd., writes that the contract for furnishing 2,012 tons 4 to 16-in. c. i. pipe and 120,000 lbs. special castings (bids opened Apr. 12) has been awarded to Oregon Iron & Steel Co., of Portland, for $71,976.

Athena, Ore.—O. G. Chamberlain, City Recorder, writes that the citizens voted Apr. 17 to issue $35,000 bonds for a gravity system of water works. The city will purchase 2½ miles of 6 and 8-in. wood pipe.

El Paso, Tex.—Local press reports state that Engr. D. H. Whitmer, of the International Water Co., is preparing plans for a power house and concrete reservoir to be constructed on the Mesa.

Marshall, Tex.—Bonds to the amount of $30,000 are reported sold to be used for extension of the water works.

Granbury, Tex.—G. W. Landers, Mayor, will receive propositions for the construction of a system of water works.

Yoakum, Tex.—The Yoakum Land & Irrigation Co. is reported as having engineers in the field running levels for the canals and will install a pumping plant with a capacity of 700,000 gals. of water per minute for irrigating 80,000 acres of land. The pumping station will be about 75 miles above Brownsville.

**Salt Lake City, Utah.*—P. P. Ford & Co., of Denver, Colo., are stated to have secured the contract for laying water mains here, for about $19,319.

Springfield, Vt.—M. L. Lawrence, Town Clk., writes that the $150,000 water bonds just sold are to be used to pay for water works already installed.

Spokane, Wash.—J. F. Fanning, of Minneapolis, Minn., has presented his report to City Council for changes in the city's water works. He recommends a new site for a 20,000,000 gal. reservoir; 4 new pumps with a total capacity of 10,000,000 gal.; a large new force main from pumping station to business district; that all mains be of steel and that the city be divided into a low service district, an intermediate district and a high service district.

**Winnipeg, Man.*—C. J. Brown, City Clk., writes that Geo. A. Metcalfe, of Winnipeg, representing the Wm. Jacks Co., of Glasgow, Scotland, has secured the contract for 171.4½ tons water pipe and 53,677 lbs. specials (bids opened Apr. 10) for a total of $66,249, freight and duty paid.

**Portage la Prairie, Man.*—The Manitoba Iron Wks., of Winnipeg, is reported to have secured the contract for a 250,000-gal. standpipe, 25 ft. diam. and 80 ft. high, and Hofferman & Heinault, of Montreal, Que., the contract for the pipe laying; probable cost $94,525.

**Hantsport, N. S.*—Geo. D. Comstock, Town Clk., writes that the contract for constructing water works (bids opened Apr. 15) has been awarded to W. J. Mulhall, of Middleton, N. S., for $39,000.

Montreal, Que.—See "Sewerage and Sewage Disposal."

SEWERAGE AND SEWAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—C. W. Hicks, City Clk., writes that the matter of constructing a sewerage system is under consideration, but no definite action has yet been taken.

Santa Rosa, Cal.—See "Water."

San Jose, Cal.—Roy Walter, City Clk., writes that plans are being prepared for a sewerage system in the College Park Dist., to cost about $50,000. The citizens will vote on the question of issuing bonds for same.

Putnam, Conn.—The House has passed a resolution authorizing this city to issue $50,000 sewer bonds.

Washington, D. C.—See "Power Plants, Gas and Electricity."

St. Augustine, Fla.—The Bd. of Trade is reported to have decided to petition City Council to construct a sewerage system; probable cost of work $94,000.

Tampa, Fla.—The Bd. of Public Wks. is reported to have authorized the City Engr. to prepare profiles for sewerage and street improvements contemplated.

Jacksonville, Fla.—Bids will be received until May 4 by the Trus. for the Water Wks. and Improv. Bonds, for furnishing material and laying about 1,720 ft. of 30-in. and 635 ft. 24-in. brick drains and 600 ft. terra cotta drain and building manholes. R. N. Ellis, Supt. sheet asphalt or paving brick.

**Augusta, Ga.*—T. O. Brown & Son, of Augusta, have secured the contract for constructing a sewer on Turknett Spring Road (bids opened Apr. 20) at the following detailed bid: 900 lin. ft. 63 in. circular brick sewer, $3.33; 734 lin. ft. 66 in., $3.62; 6 manholes, ea. $8.50, and 70 6-in. slants, ea. 20 cts.; total, $5,719.

Idaho Falls, Idaho.—Bids will be received May 12 for furnishing material and constructing a sewerage system in Dist. No. 1, as advertised in The Engineering Record.

Peoria, Ill.—The Bd. of Local Improv. is stated to have on Apr. 17 adopted a resolution for the South St. Sewer; the cost will be about $100,000. The territory embraced by this sewerage district is Lincoln Ave., Cedar, Water, Garden and Blaine Sts.

Cairo, Ill.—P. E. Powell, City Comptroller, writes that Wilbur Thistlewood is engineer in charge of proposed sewer work contemplated. Nothing definite has yet been done.

South Bend, Ind.—Bids will be received May 2 by the Dept. Pub. Wks. (W. A. McInerney, Chmn.) for constructing sewers in portions of Diamond Ave. and Fellows St.

Elkhart, Ind.—It is stated that bids are wanted May 3 for constructing a sewer in River Ave. and Mason St. Tipton, Ind.—It is stated that bids will be received May 9 for constructing a sewer. Clyde Porter, City Clk.

**New Albany, Ind.*—Press reports state that the City Council has granted permission to P. J. McNerny & Co., of Indianapolis, to transfer their contract for the construction of a sewerage system for New Albany to the Marion County Constr. Co., 529 Fulton St., Indianapolis. The contract price was $207,310.

East Longmeadow, Mass.—Bids will be received May 6 by the Bd. Selectmen (Jas. H. Rankin, Chmn.) for furnishing pipe and constructing about 1,100 ft. of surface water sewer. Durkee, White & Towne, Engrs., 292 Main St., Springfield.

**Items marked thus give the names of parties awarded contracts.*

Haverhill, Mass.—The Bd. of Aldermen is reported to have passed an order providing for an appropriation of $10,000 for the construction of sewers during the year.

Northampton, Mass.— The Fin. Com. of Council has recommended an appropriation of $20,000 for the improvement of the sewers.

**Menominee, Mich.*—John Striffler, of Marinette, Wis., has secured the contract for 6,200 ft. 8-in. sewer pipe at 65 cts. and 20 manholes ea. $34 (bids opened Apr. 10).

Pipestone, Minn.—Bids will be received May 8 by the City Council (S. W. Funk, City Recorder) for $15,000 bonds for constructing a sewerage system.

Gulfport, Miss.—The City Council is reported to have accepted the plans of Engineer W. F. Wilcox, of Jackson, for a sewerage system to cost about $20,000.

Glasgow, Mont.—See "Power Plants, Gas and Electricity."

**Wilton, N. H.*—The following are the bids opened Apr. 20 for the laying of sewer and water pipe: C. V. Carlton, Milford, $16,461; D. A. Dovey, Boston, Mass., $14,511; P. F. Brady, Boston, Mass., $13,473; M. J. O'Hern, $12,910; Osgood Constr. Co., Nashua, $12,739; Van Nest & Vosburg, $12,211; C. G. Craile, $11,378; Fales & Simmons, Somerville, Mass., $10,354; Lucien A. Taylor, Boston, Mass., $9,901; Falvey & Kelley, Boston, Mass., $9,421; E. B. Roberts, Westfield, Mass., $9,077; C. E. Trumbull, Boston, Mass., $9,036; Ablett & Bowes, Cohoes, N. Y., $8,520 (awarded contract). The detailed bid of Ablett & Bowes, the successful bidders, is as follows: 435 cu. yds. rock excav., $3.25; 20 cu. yds. concrete, $3; 5 cu. yds. rubble mas'ry, $6; 20 manholes, ea. $12; 15 flush tanks, ea. $12; 40 lampholes, ea. $1; 15,400 lin. ft. 6 and 8-in Akron sewer pipe, 30 cts.; 3,500 lin. ft. 10-in, 35 cts.; 24 6-in. c. i. pipe, 30 cts.; 24 lin. ft. 10-in., 35 cts; 800 lin. ft. 6-in. water pipe (W. W. ex.), 20 cts.; 2,500 lin. ft. 8-in., 22 cts.; 7 hydrants, ea. $2, and 4 water gates, $1.

**Jersey City, N. J.*—The Bd. of Street and Water Comrs. is reported to have awarded to Bernard Gannon the contract for the construction of a sewer under the Boule. from Danforth Ave. to Cator Ave. and from Terhune to Cator Ave. to the Boule., to connect with the Swampy Creek sewer, at 88 99-100 per cent. of the standard cost.

West New York (P. O. Taurus), N. J.—Ord J. Darling is stated to have been selected to prepare plans and specifications for the construction of a 15-in. pipe sewer in Jackson St. from 17th to 21st St.

Asbury Park, N. J.—The citizens are reported to have voted Apr. 25 to issue bonds for the construction of a sewage disposal plant. John L. Coffin, Supt. Dept. Water & Sewers.

Hoboken, N. J.—The Sewer Com. of City Council is reported to be considering the construction of a sewerage system and pumping station, to cost about $300,000.

West Hoboken, N. J.—At a meeting of the West Hoboken Council and the North Bergen Township Com., at West Hoboken, on Apr. 17, S. Maulbeck, 495 West St., and Robt. Gaw, 584 Spring St., were selected to prepare plans for a joint southern outlet sewer; the probable cost of the sewer is $34,000.

New York, N. Y.—The following are the bids opened on Apr. 20 by Louis F. Haffen, Pres. Bronx Boro., for improving Downing Brook drain: Briggs & McLaughlin, 19 E. 130th St., $11,645; Geo. M. Dunn, 737 E. 171st St., $11,945; Jos. Stanton, 1341 Webster Ave., $11,036; Molloy, Rexford & Co., Williamsbridge, $12,309; M. J. Leahy, 990 E. 156th St., $10,701, and Bellew & Merritt Co., Tuckahoe, N. Y., $30,568. M. J. Leahy, the lowest bidder, bid for 560 lin. ft. 12 in. vitr. pipe, $2.70 per ft.; 1,040 cu. yds. rubble masonry, $4; 100 cu. yds. rock excav. and removed, $3; 150 cu. yds. dry stone paving, $2; and 350 cu. yds. concrete reinforced with steel bars, $10.

Huntington, L. I., N. Y.—The taxpayers are reported to have decided on Apr. 24 to proceed at once with the formation of a sewer district and take necessary steps for the installation of a septic disposal plant to cost $45,000.

Lestershire, N. Y.—Bids will be received by the Bd. of Village Trus., May 12, for furnishing material and constructing of about 3 miles of pipe sewers, as advertised in The Engineering Record.

White Plains, N. Y.—The bill providing for a trunk sewer from White Plains through Scarsdale and East Chester to West Mt. Vernon, and thence tunnelling through the hills of Yonkers to the Hudson River, has been approved by the Common Councils of Yonkers and Mt. Vernon and the Bd. of Trus. of White Plains. Mayor Brush, of Mt. Vernon, on Apr. 22 signed the bill and sent it to Albany for the signature of Gov. Higgins. The proposed sewer will be 15 miles in length and cost about $2,000,000. The bill names Mayor John E. Andrus, of Yonkers, Pres., and John J. Brown, of White Plains, and Wm. Archer, of Mt. Vernon, Com. for 3 yrs.

Niagara Falls, N. Y.—The State Senate has passed a bill authorizing this city to issue sewer bonds.

Rye, N. Y.—The Village Clk. writes that the question of sewerage is being considered, but no definite system of sewerage has been reported as yet.

Utica, N. Y.—The Common Council is reported to have approved the Legislative bill authorizing the city to issue bonds to extend the sewerage system; probable cost of the work $200,000.

Palmyra, N. Y.—There is reported to be talk of constructing a sewerage system here.

Norwood, O.—The Council is reported to have passed a resolution providing for the construction of a sewerage system in Norwood View.

Akron, O.—Bids will be received May 8 by the Bd. Pub. Service (Chas. H. Watters, Secy.) for constructing a main trunk sewer in a portion of Maple St., with all the necessary catch basins, lampholes, manholes, ventilators and appurtenances.

Fremont, O.—It is stated that bids will be received by the Bd. Pub. Service, until May 9, for constructing a trunk sewer.

Steubenville, O.—Bids will be received May 19 by the Bd. Pub. Service (T. W. Vance, Clk.) for constructing a sewer on a portion of Washington St., to consist approximately of 2,650 ft. 36-in. sewer, 11 manholes and 17 catch basins; 300 ft. 30-in. sewer, 3 manholes and 4 catch basins; also a sewer on a portion of North St., to consist approximately of 2,200 ft. 36-in. sewer, 10 manholes and 18 catch basins, 340 ft. 30-in. sewer, 2 manholes and 2 catch basins; 150 ft. 24-in. sewer, 1 manhole and 1 catch basin; bids on labor and material to be submitted separately.

London, O.—It is stated that contracts will shortly be let for the construction of a sewerage system and disposal works; probable cost, $56,000.

Youngstown, O.—Bids will be received May 9 by the Bd. Pub. Service (G. T. Prosser, Clk.) for constructing sewers in portions of McGuffey and Garfield Sts. and Glenwood Ave.

Cincinnati, O.—City Engr. Breen estimates the cost of constructing a sewer in the East End from Columbia Ave. to Beechwood Ave. at $33,141.

Bids will be received May 8 by the Bd. Pub. Service (Geo. F. Holmes, Clk.) for furnishing materials and improving a portion of Imperial St., by constructing sewers and drains.

McKeesport, Pa.—It is stated that bids will be received until May 4 by C. C. Soles, City Compt., for constructing 15-in. terra cotta pipe in Grand St.

Harrisburg, Pa.—Bids will be received until May 4 by W. H. Lynch, Highway Comr., for constructing sewers in portions of several streets, work to include 12 and 15-in. terra cotta pipe sewer, single and double ring circular brick sewer, and also a 66-in. reinforced concrete parabolic sewer in a portion of 17th St.

Erie, Pa.—Contracts will probably soon be let for a sewer in Wayne St., to consist of 24 to 9-in. pipe sewers; probable cost, $31,000.

Mt. Carmel, Pa.—The date of opening of bids for the construction of a sewerage system has been extended from May 4 to May 18, as advertised in The Engineering Record.

Allentown, Pa.—Bids will be received by Mayor Alfred J. Yost, until May 2,, for the following work; Constructing sewers on several streets; crushed stone for improved and unimproved streets; curbing and paving in front of private property; repairs to street crossings; new street crossings; completing approaches to the Hamilton St. Bridge, cleaning paved streets, etc. Harry T. Bascom, City Engr.

**Salt Lake City, Utah.*—The following are reported to be the bids opened by the Bd. of Pub. Wks. on Apr. 10 for the construction of pipe sewers: P. J. Moran, $72,480; Palmer, Tate & Co., $75,374; W. W. Cook & Son, $76,838; Doyle Bros., $67,578, and P. P. Ford, $64,627 (awarded contract).

Ogden, Utah.—The City Council has ordered A. F. Parker, City Engr., to prepare plans and specifications for Sewer Dist. No. 10; probable cost of construction work, $110,000.

Kenosha, Wis.—Geo. W. Harrington, City Clk., writes that bids will be received May 15 for the construction of a sewerage system; probable cost, $26,640. Engineer, Robt. H. Moth, of Kenosha.

Montreal, Que.—The City Council is reported to have decided to expend this summer $10,000 for enlarging sewer in Mt. Royal Ave., St. Denis Ward; $15,000 for grading and macadamizing new streets; $10,000 for a new incinerator in the East End; $31,000 for new fire Station No. 5 on St. Catherine St., and $10,000 for new Station No. 18 in St. Denis Ward and $10,000 for laying new water pipes.

BRIDGES.

Notes Arranged Alphabetically by States.

**Oakland, Cal.*—W. J. Schmidt, of Berkeley, is stated to have received the contract for grading and constructing necessary bridges on the Mines Road, for $49,500.

**Washington, D. C.*—The contract for constructing an earth embankment for the Virginia approach to the Highway bridge over Potomac River is stated to have been awarded to Ernest L. Miner, of Petersburg, Va., for $44,800, about 70,000 cu. yds. of earth being required.

Martinsville, Ind.—It is reported that bids will be received by the Bd. Co. Comrs. until May 5 for furnishing materials and repairing, re-roofing, etc., bridge over Stotts' Creek, on Martinsville and Waverly Gravel Road; also for repairing iron bridge over White River, 1 mile west of Martinsville; B. R. Johnson, Co. Aud.

Albion, Ind.—It is reported that bids are wanted May 2 for furnishing materials and constructing an 8-ft. concrete or reinforced concrete arch across the county ditch in Allen Township; also for an 18-ft. leg girder bridge with concrete floor across the county ditch in Jefferson Township. John L. Henry, Co. Aud.

Vincennes, Ind.—It is stated that bids will be received May 3 by John T. Scott, Co. Aud., for constructing 6 steel bridges.

Rochester, Ind.—It is reported that bids will be received by the Co. Comrs. until May 26, for $50,000 bridge bonds.

**Sioux City, Ia.*—The contract for constructing a 130-ft. steel span bridge at 7th St. with 70-ft. approaches, new cylinder piers and steel floor joists is stated to have been awarded to W. Towle for $5,350.

Mt. Clemens, Mich.—The City Council is stated to have passed a resolution providing for an issue of $5,000 bonds to construct a bridge over Clinton River at Gratiot.

Minneapolis, Minn.—See "Railroads."

Ada, Mich.—R. A. Mosher, of Grand Rapids, Deputy Co. Clk., writes that it is proposed to construct a bridge over Grand River at Ada to cost about $8,000.

Floodwood, Minn.—Bids will be received May 5 by the Bd. Co. Comrs., for constructing a steel bridge over the St. Louis River at this place to be 200 ft. span, 16 ft. between trusses, on steel cased piers of piling with concrete filling not less than 3 ft. in diameter, with two 18-ft. approaches; O. Halden, Co. Aud., Duluth.

**Townsend, Mont.*—A. Y. Bayne & Co. are stated to have received the contract (bids opened Apr. 10) for constructing a steel bridge over Missouri River at Townsend for $9,838.

Trenton, N. J.—Bids will be received May 2 by the Bd. Chosen Freeholders (Thos. E. Raub, Dir.) for furnishing materials and constructing iron pipe culvert and masonry retaining walls for 2 bridges in Hopewell Township; Frank J. Eppele, Co. Engr.

**New York, N. Y.*—The Snare & Triest Co., 39 Cortlandt St. has secured the contract for constructing the University Heights Bridge and approaches over Harlem River from 207th St., Manhattan Boro., to 184th St., Bronx Boro. (bids opened Apr. 11) for $595,898. For detail list of bids received for this work see issue of The Engineering Record Apr. 22.

**Syracuse, N. Y.*—N. V. V. Franchot, State Supt. Pub. Wks., Albany, writes that the contract for constructing the superstructure of the bridge at Willow St. (bids opened Apr. 19) has been awarded to the Rochester Bridge Constr. Co., of Montour Falls, for $13,259.

Hoosick Falls, N. Y.—The following bids are stated to have been opened Apr. 10 for constructing a bridge over Walloomsac River; Cluett & Dunspaugh, $6,375; United Constr. Co., of Albany, $5,656; West Virginia Bridge & Constr. Co., $5,530; Michael Fitzgerald, of Hoosick Falls, 3 bids, $5,200, $5,500 and $5,100; Canton Bridge Co., $5,597.

Poughkeepsie, N. Y.—Mace Moulton, of Springfield, Mass., is reported to have completed plans and specifications for rebuilding the Poughkeepsie Bridge. The work will require 2 years' time. When rebuilt the structure will be capable of bearing two locomotives weighing 160 tons ea., followed by trains weighing 4,500 lbs. to the lin. ft.

Lisbon, N. D.—Bids will be received by the Co. Comrs., May 10, for constructing 2 steel bridges, 80-ft. span on tubular piers, over Sheyenne River, including approaches. Geo. W. Ferguson, Co. Aud.

Ellendale, N. D.—Bids, including specifications, will be received until May 24 by A. W. Eygabroad, Co. Aud., for constructing a steel or combination bridge across Maple River, to have 40-ft. span and 10-ft. approaches.

**Cleveland, O.*—The contract for rebuilding the superstructure of the Detroit St. bridge is stated to have been awarded (bids opened Apr. 10) to the Van Dorn Iron Wks., 1208 Woodland Ave., for $17,000.

Toledo, O.—The County Comrs. and Bd. of Pub. Service is stated to have decided to construct a new bridge over Ottawa River at Detroit Ave., replacing one recently destroyed; the estimated cost of a steel girder bridge 100 ft. long is $15,000.

Stillwater, Okla. Ter.—Bids will be received May 8 by the Bd. Co. Comrs. for furnishing materials and constructing 19 steel bridges; spans ranging from 30 to 70 ft. with a 14-ft. roadway. J. C. Donart, Co. Clk.

Pittsburg, Pa.—Bids will be received May 17 by the City Comp. for constructing a stone arch bridge on Lincoln Ave., to consist of 2 spans, each 130 ft., containing about 6,500 cu. yds. rock face Ashlar masonry with concrete backing; total estimate of concrete, about 6,600 cu. yds. Appropriation $150,000.

Kingstree, S. C.—Bids will be received May 16 by the Bd. Co. Comrs., Georgetown and Williamsburg Counties, for constructing a steel bridge, with brick foundation, 180 ft. long over Black Mingo Creek. J. J. Graham, Co. Superv.

Spokane, Wash.—The following bids are stated to have been opened Apr. 15 by the Bd. Pub. Wks. for constructing 110 ft. steel span bridge at Havermarle St.: American Bridge Co., of Seattle (2 bids), $17,000 and $16,197; Wm. Oliver, $22,800; Victor Costello, $17,400; Puget Sound Bridge & Dredging Co., of Seattle, $18,494, and Zirngibl & Marshall (2 bids), $16,339 and $15,294 (bidders all of Spokane, unless otherwise mentioned).

PAVING AND ROADMAKING.

Notes Arranged Alphabetically by States.

Pine Bluff, Ark.—It is stated that bids will be received until May 10 by the Comrs. of Paving Dist. No. 18, at the office of White & Altheimer, 106½ Main St., for paving certain streets in Paving Dist. No. 18.

**San Francisco, Cal.*—The Barber Asphalt Co. has secured the contract for paving Mission St. bet. Onondaga and Porter Ave., for about $70,000.

Denver, Colo.—The Bd. of Pub. Wks. is stated to have adopted specifications for the paving with asphalt a portion of Welton St., at an estimated cost of $49,066.

Washington, D. C.—Bids will be received by the Comrs. D. C. on May 12 for laying asphalt block pavements; also on same date for paving various streets and avenues with sheet asphalt, both advertised in The Engineering Record.

The lowest bid opened on Apr. 22 by the Comrs. D. C. for grading Pennsylvania Ave. extended was that of J. C. McGuire, of New York, N. Y., at 21.49 cts. per cu. yd. for about 73,000 yds.; total cost, $15,688.

Bids will be received by the Comrs. D. C. May 13 for grading certain streets and avenues, aggregating 25,000 cu. yds., as advertised in The Engineering Record.

Tampa, Fla.—See "Sewerage and Sewage Disposal."

Brazil, Ind.—It is reported that bids are wanted May 9 for constructing gravel roads in Van Buren Township; address W. H. Cutshall, Highway Comr.

Greencastle, Ind.—It is stated that C. C. Hurst, Auditor Putnam County, will soon receive bids for constructing about 1½ miles of gravel road in Marion Township.

South Bend, Ind.—Bids will be received May 2 by the Dept. Pub. Wks. (W. A. McInerney, Chmn.) for constructing cement sidewalks on portions of Florence and Johnson Sts., and cement sidewalks and curb on Miner St.

Items marked thus give the names of parties awarded contracts.

Logansport, Ind.—Danl. M. Tuley is stated to have received the contract for constructing the county line road, 9 miles in length, between Cass and Howard Counties, for $17,500.

Rochester, Ind.—It is reported that bids will be received by the Co. Comrs., until May 26, for $8,000 paving bonds.

Sullivan, Ind.—It is reported that bids will be received by A. V. Minich, Co. Treas., for $152,138 gravel road bonds.

**Cedar Rapids, Ia.*—T. F. McCauley, City Engr., writes that J. J. Snoffer, Jr., of Cedar Rapids, has secured the contract for paving A and B Aves. and 2d St. at the following bid: $1.30 per sq. yd. for Purington block; 40 cts. per lin. ft. for cement curb; $2 per sq. yd. for macadam; 30 cts. per cu. yd. for grading; 15 cts. per lin. ft. for 3-in. drain and 50 cts. per cu. yd. for extra sand.

**Waterloo, Ia.*—Local press reports state that the following are the bids opened on Apr. 17 by City Council (C. T. Wilson, City Engr.), for asphalt paving: (*a*) east side improvement to consist of 42,000 sq. yds. sheet asphalt with concrete foundation and binder course; 16,000 lin. ft. combined curb and gutter; 6,500 lin. ft. curb to reset; 1,800 lin. ft. of 6½x18 in. new curb; 6,500 lin, ft, new 18-in. gutter with old curb; 1,000 cu. yds. extra grading; 2,240 lin. ft. street railway track, and 200 sq. yds. between railway tracks; (*b*) west side improvement to consist of 22,000 sq. yds. sheet asphalt with concrete foundation and binder course; 10,000 lin. ft. combined curb and gutter; 3,000 lin. ft. curb to reset; 3,000 lin. ft. 18-in. gutter with old curb; 2,000 cu. yds. extra grading, and 1,200 lin. ft. 4-in. tile.

Barber Asphalt Co., *a* Trinidad, $85,547; *a* (Salidad), $80,717; *a* (Genasco), $79,247; *b* (3 bids) $43,794, $41,264 and $40,494, respectively. Hugh Murphy, Omaha, Neb., *a* (Bermuda), $98,565. McCarthy Improv. Co., Davenport, *a* (California refined), $90,328; *b* $46,587. The Barber Asphalt Co. is reported to have secured the contract for both the east and west sides at $1.55 per sq. yd. for the paving using Genasco asphalt. For extra grading, per cu. yd., 1,000 yd. haul, 32 cts.; overhaul, per cu. yd., per 100 ft., 1 ct.; resetting old curb, including redressing, finishing all joints, per lin. ft., 9 cts.; building new combined curb and gutter, per lin. ft., 44 cts.; building new 18-in. gutter with old curb, 30 cts.; building new 6½x18 in. Portland cement curb, per lin. ft., 30 cts., and for paving street railway tracks, per sq. yd., $1.96½.

Iowa City, Ia.—City Engr. Magowan is stated to have estimated the cost of paving and curbing a portion of Iowa Ave., at $50,235, about 19,463 sq. yds. bithulithic pavement and 12,042 lin. ft. of combined curbs and gutters being required; the estimated cost of paving about 6,022 sq. yds. on College and Capitol Sts. is $11,835.

Louisville, Ky.—The Mayor is stated to have approved the ordinance providing for the paving with asphalt the remaining portion of Frankfort Ave. at an estimated cost of $30,000.

Lexington, Ky.—Bids will be received until May 2 by Thos. A. Combs, Mayor, for grading, curbing and macadamizing a portion of Wooland Ave.

Baltimore, Md.—Bids will be received May 3 by the Bd. Awards (E. Clay Timanus, Pres.) for grading, curbing and paving with Belgian blocks on a portion of High St.; B. T. Fendall, City Engr.

Baltimore, Md.—The first branch of City Council is stated to have passed an ordinance providing for an appropriation of $6,000 for paving with asphalt blocks a portion of Collington Ave., also $3,000 for paving with asphalt blocks a portion of Mosher St.

*The Bd. of Awards is stated to have awarded contracts for paving as follows (bids opened Apr. 12): paving with asphalt block portions of North Ave., Orleans and Gilmor Sts. and Harlem Ave., to the Maryland Pavement Co., Equitable Bldg., at $1.99 per sq. yd. for either broken stone or gravel concrete base and $2.25 for paving between car tracks; paving with vitrified brick a portion of Ensor St., to W. M. Elder, at $2.08 per sq. yd.

The following bids are stated to have been opened by the Bd. of Awards on Apr. 12 for paving with granite block a portion of High St.: Patrick Reddington, $2.83 per sq. yd.; Patrick Flannigan & Son, $2.83 per sq. yd., and W. M. Elder, $3.14 per sq. yd.

Hagerstown, Md.—J. O. Beard, City Clk., writes that it is proposed to pave 3 streets this summer, with vitrified brick.

Bids will be received May 2 by the Co. Comrs. (John E. Wagaman, Clk.) for grading and macadamizing about 2 miles of road.

Cumberland, Md.—Bids will be received May 2 by the Bd. Co. Road Dirs. for grading and macadamizing about 1 mile of Bedford Road.

**West Boylston, Mass.*—The following are the bids opened on Apr. 14 by the Metropolitan Water & Sewerage Bd., Boston, for building a part of Newton St. and improving Crescent St., West Boylston: McBride & Co., Brighton, $4,496 (awarded contract); Auguste Saucier, So. Framingham, $4,509; Rowe & Perini, So. Framingham, $4,740; Newell & Snowling Const. Co., Uxbridge, $4,960; Boylston Contsr. Co., W. Boylston, $4,995; Meskill Bros. & Leahy, Everett, $5,320; Albert O. Bullard & Co., Sterling, $5,875; Louis Martiniello, Boston, $11,490. The detail bid of McBride & Co., the successful bidder, is as follows: 19,000 cu. yds. excav., 18 3-7 cts.; 50 sq. yds. paving, $1.50; laying 2,000 lin. ft. 5-in. sewer pipe for side drains, 11 cts., and 70,000 cu. yds. overhaul, 1 ct.

Laurium, Mich.—Bids will be received May 2 by the Common Council (Peter Charrier, Clk.) for constructing about 3,000 ft. cement walks.

Menominee, Mich.—John Striffler, of Marinette, Wis., has secured the contract for paving (bids opened Apr. 10) at 65 cts. per sq. yd. for 14,400 sq. yds. macadam; 40 cts. per cu. yd. for 3,400 cu. yds. fill; 48 cts. per ft. for 7,000 lin. ft. curb, and for 21 catch basins, $34 ea.

**Mankato, Minn.*—The following are the bids opened on Apr. 18 for paving Jackson St. with brick: T. R. Coughlan Co., Mankato, $11,503; A. Thompson, Milwaukee, $12,550; Fielding & Shepley, $10,160 (awarded contract on Purington block); Jas. B. Forrestal Co., St. Paul, $10,465; M. Ford, Cedar Rapids, Ia., $10,900, and McCarthy Imp. Co., Davenport, Ia., $11,543.

St. Paul, Minn.—The contract for constructing a stone and gravel road on a portion of St. Paul, White Bear and Bald Eagle Road is stated to have been awarded to W. J. Prendergast, for $211,478 (bids opened Apr. 17).

St. Louis, Mo.—Bids will be received May 9 by the Bd. Pub. Improv. (Hiram Phillips, Pres.) for improving by grading, curbing and paving on portions of 11 streets with vitrified brick, 4 streets with bituminous macadam, and Theodosia Ave. with asphalt.

Grenada, Miss.—Bids are wanted for constructing granolithic sidewalks. Address C. B. Bolron, Engr.

Henderson, N. C.—Bids will be received by the Bd. of Internal Improv., May 15, for constructing macadam roads as advertised in The Engineering Record.

Harrison, N. J.—The Common Council is stated to have decided to pave Worthington Ave. with bitulithic.

**Belleville, N. J.*—The contract for furnishing and delivering broken stone for repairing roads in Belleville is stated to have been awarded to Francis Marley, of Paterson, at $1.49 per ton.

Delawanna, N. J.—It is stated that bids will be received until May 2 by Allison J. Van Brunt, Township Clk., for grading and macadamizing various streets in Acquackanonk Township. Colin R. Wise, Township Engr., 34 Bloomfield Ave., Passaic.

Newark, N. J.—Bids will be received May 2 by the Essex Co. Park Comn., 800 Broad St. (A. Church, Secy.) for constructing roadway, drainage, etc., on a portion of Bloomfield Ave., grading and improving certain portions of the middle and northern divisions of Branch Brook Park, adjacent to the Bloomfield Ave. subway. Engineer's estimate: 3,000 cu. yds. earth excav.; 270 lin. ft. 6-in., 600 lin. ft. 8-in., and 200 lin. ft. 12-in. vitr. pipe; one 24-in. lawn basin; 4 road basins; 4 street catch basins; 110 cu. yds. concrete retaining wall; 660 lin. ft. straight axed curb; 120 lin. ft. curved axed curb; 275 lin. ft. old curb reset; 920 sq. yds. 8-in. and 700 sq. yds. 12-in. Telford roadway.

**Hoboken, N. J.*—Jas. H. Londrigan, City Clk., writes that the contract for grading, curbing and paving with Belgian block on Adams St. (bids opened Apr. 26) has been awarded to Henry Waddington, 619 Jefferson St.

Freehold, N. J.—Bids will be received until May 10 by the Bd. Chosen Freeholders (John Guire, Dir.) for constructing a macadam road in Matawan Township, in all about 3,365 ft. long, as advertised in The Engineering Record.

New York, N. Y.—Bids will be received May 4 by the Comrs. Parks (John J. Pallas, Pres.) for furnishing materials and constructing walk pavements of rock asphalt mastic with concrete base and rubble stone foundation, at the entrances to Central Park at 59th St. and 7th Ave., and at 66th St. and Central Park West.

Johnstown, N. Y.—The Council on Apr. 24 passed a resolution providing for the paving of Market St. with Warren Bros.' bitulithic pavement. J. F. Campbell, City Engr.

Cortland, N. Y.—The Bd. of Pub. Wks. is stated to have authorized the City Engr. to prepare plans and specifications for paving a portion of Pendleton St.

*The American Road Roller Co., of Groton, is stated to have received the contract for furnishing a road roller at $2,000.

Troy, N. Y.—Bids will be received until May 2 by Elias P. Mann, Treas. Rensselaer County, for $70,000 highway improvement bonds.

Ft. Ontario, N. Y.—Bids will be received by Capt. W. M. Coulling, Q.M., U. S. A., Oswego, on May 27 for furnishing material and constructing roads and walks at Ft. Ontario, as advertised in The Engineering Record.

Elmira, N. Y.—The Bd. of Pub. Wks. has decided to pave Clinton St. and bids will be received on May 10 by the City Clk. for curbing. F. Leach, City Engr.

**Cincinnati, O.*—The following are the bids opened on Apr. 17 by the Bd. of Pub. Service for improving a portion of Race St., including the laying of 8,960 sq. yds. asphalt: Barber Asphalt Paving Co., $12,821; Kercliner Contr. Co., 8th and Plum Sts., $11,831 (awarded contract); Henkel & Sullivan, $14,585, and Cleveland Trinidad Asphalt Paving Co., $15,047.

Columbus, O.—The City Council is stated to have passed ordinances providing for the improving and repairing portions of Locust St., Neil and Dennison Aves. and numerous streets.

Celina, O.—It is reported that bids are wanted May 15 for $4,000 street improvement bonds. F. H. Kreusch, City Clk.

**Uhrichsville, O.*—H. Snyder, Village Clk., writes that the following are the bids opened on Apr. 10 for paving W. 3d St. with fire brick, 10,700 sq. yds.: W. H. Vogt & Sons, Massillon, $15,783 (awarded contract); P. A. Romig, Uhrichsville, $19,730; Baldwin Bros. & Graham, 525 Citizens' Bldg., Cleveland, $18,346; Couch & Kunkle, Dayton, $17,671; McCallam & Sons, Uhrichsville, $18,089; A. G. Pugh, Union Nat. Bank Bldg., Columbus, $19,536; Downs & Campbell, $16,061; E. A. Freshwater & Sons, Chester, W. Va., $17,808; J. G. McGuire, New Brighton, Pa., $18,705; F. E. Dean, Niagara Falls, N. Y., $17,373, and J. N. Lorenz & F. Rufenacht, Uhrichsville, $20,380.

Wyoming, O.—Bids will be received May 22 by the Village Council (W. A. Clark, Clk.) for improving portions of Wyoming, Springfield, Elm and Wentworth Aves., by grading, curbing, guttering and macadamizing.

Akron, O.—Bids will be received by the Bd. Pub. Service (Chas. H. Watters, Secy.) until May 5, for furnishing material and improving a portion of Spencer St., by grading, curbing and paving with bricks.

Edgewood, Pa.—Bids will be received May 8 by Geo. W. Schusler, Boro. Engr., for grading, curbing and paving a portion of Locust St.

Meadville, Pa.—Petitions have been presented to Council for the paving of Park Ave. 13,000 sq. yds. of brick and about 8,000 sq. yds. block asphalt.

Mahonoy City, Pa.—Bids will be received May 2 by the Finance Com., Boro. Council (John J. Foley, Chmn.) for $35,000 street paving bonds.

Allentown, Pa.—See "Sewerage and Sewage Disposal."

York, Pa.—Bids will be received May 11 by the Highway Com. (Henry S. Wallack, Chmn.) for paving 8,840 sq. yds. of N. George, S. Beaver and W. York Sts., with

**Salt Lake City, Utah.*—The Bd. of Pub. Wks. is stated to have opened bids as follows on Apr. 10 for constructing cement sidewalks: P. J. Moran, $33,150; Palmer, Tate & Co., $29,900; Page, Swan & Perkins, $32,825; John F. Schmidt, $31,059; Rudolph S. Bloom Co., $31,100; W. W. Cook & Son, $38,105; Western Art Stone Co., $34,451, and the Utah Fireproofing Co., $29,230 (awarded contract).

**Seattle, Wash.*—The Sparger Concrete Co., Lumber Exchange, is stated to have received the contract for paving a portion of Olympic Pl., for $14,575.

Bellingham, Wash.—The City Council is stated to have passed an ordinance providing for the paving with asphalt a portion of Elk St., probable cost of the improvement $30,000. According to reports bids will soon be received.

**New Brighton, S. I., N. Y.*—The following are the bids opened on Apr. 11 by Geo. Cromwell, Pres. Richmond Boro., for paving with vitrified brick: (*a*) Russell Contr. Co., 156 5th Ave., N. Y. City; (*b*) John E. Donovan, Port Richmond; (*c*) Jos. Johnson's Sons, West New Brighton; (*d*) John F. Donovan, West New Brighton; (*e*) E. A. Matthews, 13 Park Row, N. Y. City:

**Post Ave. from Columbia St. to Jewett Ave.*

	a	*b*	**c*	*d*	*e*
6,640 sq. yds. vitr. brick	$2.15	$2.35	$1.92	$2.08	$2.10
3,000 lin. ft. curb	.95	1.00	.95	.97	1.00
850 cu. yds. concrete	5.40	5.50	4.50	5.30	5.45
20 sq. ft. 6-in. bluestone	.50	.80	1.00	.70	1.00
24 sq. ft. 3-in. bluestone	.35	.40	.30	.35	.50
Total	$21,752	$23,322	$19,464	$21,274	$21,625

**Waters, College and Willard Aves.*

	b	*a*	*d*	*e*	**c*
3,900 cu. yds. excav.	$0.50	$0.75	$0.43	$0.50	$0.48
2,500 lin. ft. 4-in. underdrain	.35	.15	.20	.25	.24
10,150 sq. yds. macadam	.98	.95	.87	1.10	.84
3,900 sq. yds. vitr. brick pavt.	2.25	2.40	1.88	2.10	1.90
590 cu. yds. concrete	5.50	6.00	5.25	6.00	4.75
51 lin. ft. 20-in. curb	1.00	1.00	.90	1.00	.95
Total	$25,692	$26,352	$21,896	$25,980	$21,695

**Mankato, Minn.*—The following are the bids opened on Apr. 18 for paving Front St. with brick: (*a*) T. R. Coughlan, Mankato; (*b*) A. Thompson, Milwaukee, Wis.; (*c*) Fielding & Shepley, St. Paul, (awarded contract); (*d*) Jas. B. Forrestal Co., St. Paul; (*e*) M. Ford, Cedar Rapids, Ia.; (*f*) McCarthy Improve. Co., Davenport, Ia. The contractors all bid on Purington block only, with the exception of J. B. Forrestal, who bid on Indiana, Barr and Purington block. Price for paving included excav. 1 ft. deep 6 in. natural cement concrete base, Pioneer asphalt filler. 5-yr. guarantee.

	a	*b*	**c*	*d*	*e*	*f*
21,086 sq. yds. brick paving	$2.11	$2.28	$1.91	$1.97	$2.01	$2.10
275 lin. ft. stone curb	.70	.65	.50	.55	.45	.70
625 ft. trimming walk	.20	.20	.15	.20	.10	.15
532 ft. resetting curb	.25	.15	.08	.10	.09	12
10 iron corners "A"	6.00	5.00	3.15	5.00	5.00	6.00
3 iron corners "B"	8.20	10.00	3.25	5.00	6.25	8.00
22 iron grates "C"	11.70	15.00	8.40	10.00	9.50	12.00
4 manhole frames and covers	6.50	5.00	7.00	10.00	4.00	7.00
144 ft. 8-in. sewer pipe	.40	.50	.75	.30	.12	.45
25 ft. 10-in. sewer pipe	.50	.60	.75	.40	.14	.55
24 ft. 12-in. sewer pipe	.60	.75	.75	.45	.18	.65
Total	$45,394	$48,994	$40,946	$42,277	$42,935	$45,080

**Items marked thus give the names of parties awarded contracts.*

Bluefield, W. Va.—Bids will be received by J. E. Crockett, Recorder, May 22, for paving Princeton Ave. with vitrified paving block, 10,600 sq. yds., as advertised in The Engineering Record.

**Oshkosh, Wis.*—John Rasmussen & Son, of Oskhosh, have secured the contract for paving John and George Sts. with macadam (bids opened Apr. 7). They bid for about 3,136 sq. yds. macadam and grading, 52 cts. per sq. yd. and 42 cts. per lin. ft. for curb. Geo. H. Randall, City Engr.

Milwaukee, Wis.—The resurfacing with asphalt on Wisconsin St. is reported under consideration.

**La Crosse, Wis.*—The La Crosse Stone Co., of La Crosse, has secured the contract for paving, bids opened on Apr. 15, for $56,646. It will consist of 25,081 sq. yds. Metropolitan block, 9,085 lin. ft. curb, 12,076 cu. yds. grading and 3,934 lin. ft. headers.

*Contracts for paving with granite top macadam (bids opened Apr. 18) have been awarded as follows: To the La Crosse Stone Co. for State St. and West Ave., $12,050, and to Wooley & Hanson, of La Crosse, for Division and Jackson Sts., $25,834.

Ft. Mackenzie, Wyo.—Bids will be received May 20 by Capt. Jas. S. Parker, Constructing Q.M., U. S. A., Sheridan, for constructing concrete walks here.

Montreal, Que.—See "Sewerage and Sewage Disposal."

POWER PLANTS, GAS AND ELECTRICITY.

Notes Arranged Alphabetically by States.

Gadsden, Ala.—If the City Council grants Judge Jas. A. Bilbro a franchise for a gas plant, he will also construct a steam heating plant.

Anniston, Ala.—Bids will be received May 3 at the Treasury Dept (H. A. Taylor, Asst. Secy), Washington, D. C., for manufacturing and placing in position in complete working order in the U. S. Post Office here certain combination gas and electric light fixtures.

Little Rock, Ark.—The Merchants' Investment Co. is reported incorporated with a capital of $250,000 to construct and operate an electric light plant. Incorporators: C. J. Kramer, Wm. S. Mitchell, J. B. Wishendorff and others.

Anaheim, Cal.—The City Clerk writes that the Bd. of City Trus. has authorized Engr. A. L. Lewis to prepare a report on the extension of the electric light plant and an increase of the water supply.

Santa Rosa, Cal.—See "Water."

San Francisco, Cal.—W. E. Condon, Ch. Engr., Owens River Water & Power Co., 411 Kohl Bldg., writes that it is proposed to construct a 3,000-h.p. plant, and a 105-mile transmission line to Tonopah and Goldfield. Nev. Preliminary surveys have been completed; probable cost of work $350,000.

Washington, D. C.—Bids will be received May 2 by Brig.-Gen. A. W. Greely, Ch. Signal Office, U S. A., War Dept., for furnishing the Signal Corps 500 McIntyre sleeves for No. 12 wire; 1,000 paper sleeves, ⅛x3; 5,000 ft. each of 15 and 20-pair, 2,000 ft. 30-pair, 1,000 ft. 40-pair, and 12,000 ft. 10-pair paper insulated aerial cable, etc. Also on May 3 for furnishing 500 iron poles with foot supports; 500 iron crossarms, and 100 attachments to iron poles for wooden crossarms.

Bids will also be received May 23 by the Bureau Supplies and Accounts, Navy Dept., for furnishing at the Navy Yards, Mare Island, Cal., and Puget Sound, Wash., a quantity of naval supplies, etc., as follows: Motor, incandescent lamps, battery cells, spare parts for Lorenz switch, T rails, piles, rock crusher, pipe and fittings, machinery, etc. H. T. B. Harris, Paymaster-Gen., U. S. N.

Bids will be received by the Comrs., D. C., on May 31, for constructing and installing heating, lighting, power plant and water supply for Industrial Home School, at Blue Plains, D. C., also sewerage system to connect with or form extension of sewerage of the Almshouse, as advertised in The Engineering Record.

Monticello, Fla.—The Monticello Power Co. is reported incorporated with a capital of $10,000 to operate an electric light and power plant.

Alachua, Fla.—The Alachua Ice & Water Co. is reported incorporated with a capital of $25,000 to construct an ice plant, water works and a gas or electric light plant. Incorporators: R. L. Stringfellow, R. R. Livingston, and others.

Eustis, Fla.—Armstrong & Smith are reported to have petitioned Council for a franchise for water works and an electric light plant.

Monroe, Ga.—The citizens are reported to have voted Apr. 20 to issue $15,000 bonds for an electric light plant. Engr., J. B. McCrary, of Senoia.

Athens, Ga.—Bids will be received at the Treas. Dept., Washington, D. C. (H. A. Taylor, Asst. Secy.), until May 2, for furnishing and placing in position certain combination gas and electric light fixtures in the U. S. Court House and Post Office here.

Weiser, Idaho.—Engr. A. E. Fox, of Weiser, writes in regard to the construction of a power plant on Weiser River, that the work is not assured yet, but it will probably be done; if constructed it will cost $50,000. Pitts Ellis & Co. are interested in this plant.

East St. Louis, Ill.—The City Council has granted the St. Clair Light & Power Co. permission to erect poles and wires in this city provided the company will erect a power house at a cost of not less than $50,000, within a year. R. W. Sitking, Secy., 136 Collinsville Ave.

Mason City, Ill.—C. W. Warnock writes that there is talk of constructing an electric light plant but nothing definite has yet been done. According to press reports, an election will soon be held to vote on the question.

**Lockport, Ill.*—S. D. Griffin, of Chicago, Clk. Bd. Trus., Sanitary Dist. of Chicago, writes that Hayes Bros., of Janesville, Wis., have secured the contract for the construction of a power house for the Lockport power development (bids opened Apr. 12) for $293,492. For detail list of bids received for this work see issue of The Engineering Record Apr. 22.

Ft. Sheridan, Ill.—Bids will be received May 10 by Capt. Wm. Weigel, Constructing Q. M., U. S. A., for furnishing and installing electric light fixtures and wattmeters in 14 buildings here.

Carlinville, Ill.—C. W. Carr, of Virden, is reported interested in the construction of an electric light plant in Carlinville.

**Plainfield, Ind.*—W. W. Wilson, of Danville, is reported to have secured the contract for constructing an electric light plant at Plainfield.

Maquoketa, Ia.—The Maquoketa Light & Htg. Co. is reported incorporated to install a gas plant; capital $25,000.

Girard, Kan.—W. K. Palmer, 718 Dwight Bldg., Kansas City, Mo., has been selected as Consulting Engr. in connection with improvements about to be made to the electric light plant and water works at Girard.

Argentine, Kan.—The Sante Fe Ry. Co. is reported to have decided to construct a power house and electric plant here for its shops and to light its yards; probable cost, $48,000. W. B. Storey, Ch. Engr., Topeka.

Louisville, Ky.—It is stated that bids will be received until May 15 by the Belknap Hardware & Mfg. Co. (Wm. Heyburn, Treas.), 111 W. Main St., for installing an electric light, heat and power plant, including two 75-kw. generators, direct connected; one 30-kw. generator, direct connected; two 110-h.p. engines, compound; one 46-h.p. engine, simple; two 150 h.p. water-tube boilers; two 150-h.p. boiler-feed pumps; one 200-h.p. feed-water heater; 1 switchboard and instruments, necessary breeching, piping, tubing, ventilating apparatus, pneumatic-tube system, including blowers, etc.

**Lake Charles, La.*—Local press reports state that the Lake Charles Ice, Light & Water Wks. Co. has awarded contracts for equipment for its plant as follows: To the Westinghouse Electric Mfg. Co., Pittsburg, Pa., for 3 generators, a converter, 2 transformers, and a 9-panel switchboard; to Alberger Condenser Co., of Newburg, N. Y., for a surface condenser; Casey & Hedges Mfg. Co., of Chattanooga, Tenn., for boilers, and to the Dodge Mfg. Co., of Mishawaka, Ind., for a rope-driving device.

Wellesley, Mass.—The citizens are reported to have voted Apr. 18 to appropriate $32,000 for the construction of an electric lighting sub-station. The town will not make its own electricity but will purchase it from Vincent Goldthwait, of Westboro.

Traverse City, Mich.—A committee is stated to have been appointed to visit plants in certain Michigan cities and prepare prices on a plant from 100 to 200-light capacity.

Battle Creek, Mich.—The citizens are reported to have voted Apr. 9 in favor of municipal ownership of the gas and electric light plants.

Pentwater, Mich.—Harry J. McDargh, Conover Bldg., Dayton, O., is preparing for the development of 700 hp. under a 28-ft. head on Pere Marquette River for the Oceana Electric Light & Power Co. B. C. Lindley, Pres., Pentwater. A timber dam, 300 ft. long, with a concrete retaining wall back of power house will be used for damming the steam.

Belding, Mich.—The Belding Gas Co. is reported incorporated with Henry J. Leonard, Pres. and Gen. Mgr., and Walter S. Lambertson, Secy., to construct and operate a gas and heating plant.

Melrose, Minn.—It is reported that F. J. Weiser, City Clk., will receive plans for water works and an electric light plant.

**St. Paul, Minn.*—Paul Doty, Gen. Mgr., St. Paul Gas Light Co., writes that contracts have been awarded as follows: For a new gas holder to Stacey Mfg. Co., Cincinnati, O.; two 600-hp. boilers to Springfield Boiler Co., Springfield, Ill., and one 450-kw. storage battery to Electric Storage Battery Co., of Philadelphia, Pa.

Marshall, Minn.—John R. Gray, City Recorder, writes that it is not proposed at this time to make any improvements to the electric light plant and water works.

South St. Paul, Minn.—The South St. Paul Power, Htg. & Lighting Co. is about to petition the Village Council for a franchise. Emil Erick and John Coates are among the incorporators.

Fairmont, Minn.—C. I. Tenny, of Dell Rapids, S. D., is reported interested in the construction of a gas plant at Fairmont.

Montrose, Miss.—The Montrose Lumber Co. is reported to have decided to ask for a charter, with a capital of $25,000, to manufacture lumber and turpentine and construct electric light plant and water works. Incorporators: John O. Gusham, W. P. Hutto and others.

Starkville, Miss.—T. M. Cummings, City Clk., writes that it was voted Apr. 15 to issue $8,000 bonds to improve water works and electric light plant.

Fulton, Mo.—Bids will be received May 9 by the Bd. Mgrs. State Hospital for the Insane No. 1, for additions and changes in pipe work for power and heating plants, and the addition of a vacuum system. M. F. Bell, Archt.

Glasgow, Mont.—A. W. Mahon, City Engr., writes that estimates have just been submitted to Mayor and Council for water works and an electric light plant; a sewerage system will probably be constructed, too, the entire cost to be $60,000.

Ponca, Neb.—J. R. Pomeroy, City Clk., writes that the lighting bonds did not carry at the recent election and it is proposed to again vote on the question.

Grand Island, Neb.—C. A. Baldwin, City Engr., writes that at the corporation election Apr. 4 the citizens voted to construct an electric light plant to cost not more than $35,000. It is proposed to vote on bonds, later, which will determine the matter.

**Beverly, N. J.*—The Cinnaminson Electric Light, Power & Htg. Co., of Riverside, is reported to have secured the contract for lighting the city by electricity for 5 yrs. at $2,850 per yr.

New York, N. Y.—Plans have been filed for a 4-story brick and stone power house to be constructed at Crosby and Broome Sts. at a cost of $50,000. Owner and architect the New York Edison Co., 55 Duane St.; also for erecting a 2-story brick and stone extension to 2-story power house at 128 E. 121st St., at a cost of $40,000 for the same company.

The following are the bids opened on Apr. 20 by Geo. W. Best, Comr. of Bridges, for the construction of an electric lighting station and equipment at Tompkins St. and Delancey Slip, for the Williamsburg Bridge: Northeastern Constr. Co., Fuller Bldg., $51,973; P. J. Gerstle, 44th St. and 1st Ave., $49,381; Kelly & Kelley, 45 E. 42d St., $55,900; Edw. Burham, 71 Wall St., $56,437, and Johnston Livingston, Jr., Co., 113 E. 22d St., $49,679.

Bids will be received May 5 by Nicholas J. Hayes, Fire Comr., for furnishing materials and making additions and alterations to the electric lighting systems in Hook and Ladder Co. No. 26 and Engine Co. No. 76, Boro. Manhattan; Engine Co.'s No. 41, 43 and 62, and Hook and Ladder Co. No. 27, Boro. Bronx.

**Brooklyn, N. Y.*—The following are the bids opened on Apr. 24 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing electric equipment in Commercial High School, Brooklyn Boro.: Peet, McAnerney & Powers, $30,340; W. M. Sheehan & Co., $33,237; Fredk. Pearce Co., $36,851; Reis & O'Donovan, $33,940 and Commercial Constr. Co., 1 Madison Ave., N. Y. City, $29,688 (awarded contract).

Phoenix, N. Y.—The Phoenix Fuel, Light & Water Co., of Phoenix, is reported incorporated, with a capital of $100,000, by J. O. Hawley and L. C. Hall, of Canandaigua.

Potsdam, N. Y.—The Raquette River Power Assoc., of Potsdam, is reported incorporated to look after the care, protection, maintenance and improvement of the water supply and water power on Raquette River. Directors: Fred L. Dewey and Rufus L. Sisson, of Potsdam; Francis M. Hugo, of Watertown, and others.

Buffalo, N. Y.—The Bd. of Aldermen is stated to have passed the ordinance granting a franchise to the Iroquois Electric Co.

Malone, N. Y.—The Malone Light & Power Co. is reported to have under consideration the installing of a complete duplicate plant.

Greensboro, N. C.—R. H. Gamwell, Engr. Greensboro Electric Co., writes that about $150,000 will be expended in the enlargement of the present plant.

Grand Forks, N. D.—B. F. Brockhoff, City Clk., writes that it is proposed to construct an electric light plant at a cost of $30,000. J. J. Smith, City Engr.

**Barnesville, O.*—E. M. Wilkes, Village Clk., writes that the contract for lighting the village by electricity (bids opened Apr. 20) has been awarded to the Barnesville Gas & Electric Light Co., of Barnesville, at $75 per light per yr. for arc lights and $19 per light per yr. for incandescents.

Dayton, O.—The City Council is reported to have granted a 25-year franchise to the Buckeye Natural Gas Co., of Circleville.

Newark, O.—Frank T. Maurath, City Aud., writes that bids for the purchase of $15,000 bonds will be received on May 25 to be used to rebuild the electric light plant.

**Pittsburg, Pa.*—Contracts for the gas engines and electric generators for the light and power plant of the Carnegie Technical Schools are stated to have been awarded to the Westinghouse Electric & Mfg. Co., for about $33,000.

Scranton, Pa.—An ordinance has been introduced in Council granting a franchise to the West Scranton Light, Heat & Power Co.

Allentown, Pa.—The Merchants' Light & Power Co. has petitioned Council for a light and power franchise.

Vermillion, S. D.—The citizens are reported to have voted in favor of municipal ownership of the electric light plant.

Nashville, Tenn.—The following are the bids opened on Apr. 18 by the Bd. of Pub. Wks. for furnishing and installing a complete 400-h.p. generating set in the city lighting plant; Braid Electric Co., $11,995, and Bullock Electric Mfg. Co., $12,317.

El Paso, Tex.—See "Electric Railways."

Norfolk, Va.—Bids will be received May 2 at the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., for furnishing at the Navy Yard, Norfolk, a quantity of supplies, including electrical supplies, wire, steam pumps, etc. H. T. B. Harris, Paymaster Gen., U. S. N.

Richmond, Va.—Bids will be received by W. P. Knowles, Supt. City Gas Wks., on May 8 for the construction of a 10-in. pipe line about 3⅓ miles in length; also a brick boiler house, steel smoke stack, etc., as advertised in The Engineering Record.

Fincastle, Va.—Doggett & Breckenridge contemplate constructing an electric light plant here. Plans have not yet been decided upon.

Bristol, Va.—It is reported that bids will be received until May 10 by Pres. J. W. Mort, for a franchise to operate electric light and power plants in Bristol.

Burlington, Wis.—John T. Brasch, City Clk., writes that it was voted Apr. 4 to construct an electric light plant.

**Green Bay, Wis.*—Le Claire Bros., of Green Bay, are stated to have secured the contract for installing an electric light plant at the County Asylum, for about $5,000.

Montreal, Que.—The Bd. of Aldermen is reported to have under consideration the construction of a municipal gas plant.

ELECTRIC RAILWAYS.

Notes Arranged Alphabetically by States.

Bisbee, Ariz.—It is reported that bids are wanted until May 8 for a franchise to construct a street railway in this city; C. W. Hicks, City Clk.

Red Bluff, Cal.—It is reported that E. B. Walbridge has applied for a franchise to construct an electric railway from Red Bluff to Tuscan Springs and to include the right to cross the bridge spanning the Sacramento River and bids for said franchise to be received by the Bd. Superv. (H. C. Kauffman, Pres.) until May 10.

Lewiston, Idaho.—It is reported that the Lewiston & Southeastern Electric Ry. Co. contemplates constructing an extension of the line from Grangeville to Boise, Col. Judson Spofford, Pres.; W. H. Hill, Ch. Engr.; F. J. Randolph, Secy and Treas.

Chicago, Ill.—The Chicago, Kankakee & Champaign Electric R. R. Co. is reported incorporated to construct a road from Champaign in a northerly direction through the counties of Champaign, Iroquois and Kankakee to Kankakee, and in a northwesterly direction through the counties of Will and Cook to Chicago. Incorporators and Directors are E. D. Risser and R. A. McCracken, of

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**Items marked thus give the names of parties awarded contracts.*

Paxton, Ill.; Upton Schaub, of Watseka, Ill., and C. V. Donovan, C. C. Patton and W. J. Boot, of Chicago.

Muncie, Ind.—The Dayton & Muncie Traction Co. is stated to have received a franchise to construct a line over Jackson St., from the bridge now being constructed near the old wagon bridge, east to the Lake Erie & Western trestle, which will be utilized, and from that point over a private right of way to Lincoln St., thence north to Main St., where connection will be made with the line of the Union Traction Co.

Evansville, Ind.—The Evansville & Mount Vernon Electric Co. is reported organized, with a capital of $300,000, to build an electric railway between Evansville and Mount Vernon. Directors are Dr. Edwin Walker. Fred. W. Reitz, F. P. Leonard and others.

Sioux City, Ia.—The construction of an interurban line from Sioux City to Ireton is reported under consideration. The plan is to build by way of Le Mars and thence in a northwesterly direction to Ireton, or else build an air line direct from Sioux City to Ireton, with a branch running from a point on the line easterly to Le Mars. R. H. Burton Smith, of Sioux City, is reported interested.

Alba, Ia.—D. R. Francis, John Scullian, John J. Lichten, of St. Louis, Mo., and others are stated to have in contemplation the construction of an interurban railway to connect Ottumwa, Oskaloosa and Albia, Ia. A company will be organized with a capital of $750,000 with headquarters at Oskaloosa. The plan is to build out from Oskaloosa to Eddyville and thence to Buxton. From Eddyville the line will be constructed southeasterly to Ottumwa, and from Buxton an extension will be constructed to Albia.

Des Moines, Ia.—A. E. Parks, of Chicago, Ill., is reported to have in contemplation the construction of an electric interurban railway from Des Moines via Winterset to Creston, Ia.

Boston, Mass.—Bids will be received by the Boston Transit Comn., May 16, for constructing Sect. 5 of the Washington St. tunnel from Franklin St. to near Court Ave., as advertised in The Engineering Record.

**Worcester, Mass.*—Edward F. Smith, of Worcester, is stated to have been awarded the contract for excavating and grading construction for the Providence & Woonsocket St. Ry.

Adrian, Mich.—It is stated that the Toledo & Michigan Electric Ry. Co. will construct an electric railway between Adrian, Cadmus, Clayton, Hudson, Janesville and other places. P. P. Dukert, Pres., Toledo, O.

Meridian, Miss.—The Mobile, Jackson & Kansas City R. R. Co. (A. N. Bullitt, Ch. Engr., Mobile, Ala.) is reported to have decided to construct a branch line from Meridian, 30 miles in a southwesterly direction, tapping the main line at a point about 20 miles south of Newton; also a branch northwesterly from Meridian, striking the main line at Philadelphia, Miss., to be 50 miles in length, and the Mehan-Rounds Lumber Co.'s road of 10 miles has been purchased to form part of this line.

Hudson Heights, N. Y.—It is reported that the Edgewater & Hudson View Const. & Traction Co. proposes to build an electric railway on the river road from Edgewater, running south through Edgewater Township, North Bergen, Guttenberg and West New York to a point near the old West Shore Ferry Landing. The line will be single track and will extend a distance of 4½ miles. August Sieber, Pres.; Wm. M. Schultz, sec.; Robt. H. Sanders, Treas.

Syracuse, N. Y.—The Syracuse & Suburban R. R. is stated to have decided to extend the line to Cazenovia, on Cazenovia Lake, 8 miles distant.

Defiance, O.—It is stated that the Cincinnati, Toledo & Detroit Short Line Ry. Co. will construct a line from Toledo to Cincinnati.

Steubenville, O.—The Tri-State Traction Co. contemplates constructing a line from Steubenville to Wellsburg, W. Va., by way of the West Virginia side of the Ohio River. D. J. Sinclair, of Steubenville, is reported interested.

Marion, O.—T. A. Gruber, of Caledonia, is reported to be securing right of way for a line from Marion to Galion. It is stated that John G. Webb, pres. of the Columbus, Delaware & Marion Ry. is reported interested.

Norwalk, O.—D. D. Washburn is reported to be considering the construction of an electric railway from Norwalk to Mansfield via Olean and Greenwich.

**Patton, Pa.*—E. W. Hess, of Clearfield, Engr. Northern Cambria St. Ry. Co., writes that the construction of a line between Patton and Barnesboro, 12 miles of the 25 miles in contemplation, is now assured, the finances being in hand. Line will be interurban, steam road construction. Power plant will be built at first for 600-h.p., and arranged for extensions. Will use direct-current 550 volts. W. H. Denlinger, Patton, Pres. Contractors, Tennis Bros.' Constr. Co., Pittsburg.

**Lancaster, Pa.*—P. McManus & Co., of Philadelphia, is stated to have secured the contract for building an 8-mile branch of the Lancaster & Oxford R. R. from Fairmount to Quarryville.

**Llanerch, Pa.*—The Philadelphia & West Chester Traction Co. is stated to have awarded the contract for the grading and masonry work upon its second track from 63d St., Philadelphia, to Monoa, to Millard & McGraw, of Philadelphia. The improvements in this section alone will cost about $100,000, in addition to the new $100,000 power station at Ridley Creek. It is planned to extend the Ardmore branch from its present terminus to a point on the Lancaster Pike, opposite the Pennsylvania R. R. Station. A branch line from Llanerch to Garrettford and Landsdowne is in contemplation.

Harrisburg, Pa.—It is reported to be the intention of the Cumberland Valley R. R. Co. to convert the Dillsburg and Mechanicsburg branch, as well as the Waynesburg branch into third-rail electric lines this year.

Spearfish, S. D.—The Black Hills Traction Co., with headquarters at Spearfish, is reported incorporated, with a capital of $400,000, to construct an electric railway from Deadwood and Lead to Belle Fourche, by way of Spearfish, a distance of 35 miles, and to supply electricity for lighting and power purposes along the right of way of the road. Incorporators are: Richard B. Hughes, Henry Keets, Jas. F. Summers, Milton L. Brenn and Robert F. Crawford, all of Spearfish. The purpose of the company is to extend the line out into the territory covered by the government irrigation project on the Belle Fourche River as soon as that section begins to develop.

Nashville, Tenn.—The Nashville Interurban Ry. Co. is reported to have decided to increase the capital from $50,000 to $400,000 for construction purposes. The company is a consolidation of the two companies which proposed to build electric lines from Nashville to Columbia and Gallatin. Directors are W. J. Whitthorne, John A. Pitts, H. E. Howse and others.

El Paso, Tex.—Geo. A. Nicholas, of Baltimore, is stated to have received a franchise to construct a street railway to Ft. Bliss and an electric light and power plant in El Paso.

Victoria, B. C.—The British Columbia Electric Ry. Co. is stated to have approved an agreement providing for the electrical operation of a railway between Vancouver and Steveston. An increase of $1,000,000 in capital has been authorized.

Hamilton, Ont.—The Hamilton, Galt & Berlin Electric Ry. Co. which contemplates a line from Hamilton to Galt, Berlin and Ancaster, is stated to have received a franchise to build to Guelph, Hespeler and Preston.

Brantford, Ont.—The House of Commons is stated to have passed a bill authorizing the Brantford & Woodstock Ry. Co. to build an electric railway between Brantford and Woodstock, passing through the townships of Brantford, East Oxford, Burford and Blandford. Promoters are C. H. Waters, of Brantford; D. W. Karn, of Woodstock, and others.

St. Catherines, Ont.—W. J. Aikens and W. F. Askin, of Dunville, and N. B. Gash, of Toronto, and others are reported interested in the construction fo an electric railway from St. Catherines to Port Dover.

RAILROADS.

Notes Arranged Alphabetically by States.

Star City, Ark.—A charter has been granted to the Arkansas, Louisiana & Gulf Ry. Co., of Star City, to build a road from Star City to Portland, to pass through the counties of Lincoln, Drew and Ashley, to be about 60 miles in length; capital $1,000,000. Incorporators: E. A. Sunderlin, Colorado Springs, Colo.; H. P. Lucas, Star City, and others.

Chicago, Ill.—Press reports state that the Chicago & Eastern Illinois R. R. Co. (J. F. Hinckley, Ch. Engr., St. Louis, Mo.) will expend about $1,500,000 in improvements, to include additional telegraph and telephone lines, water softening plants, a large increase in yard facilities at Chicago and other terminals, 30 miles of third track in addition to the present double track, signal towers and passing sidings.

Wabash, Ind.—The Indiana Northern Ry. Co. (J. D. Oliver, Mgr., South Bend, Ind.) is stated to have decided to begin the construction of the road from Wabash to North Manchester as soon as right of way can be secured.

Indianapolis, Ind.—The contract by which the Indianapolis Southern Ry. Co. agrees to elevate its tracks through the 12th and 13th Wards was approved by the Bd. of Works on Apr. 14.

Greenville, Ga.—The Central of Ga. Ry. Co. (H. M. Steele, Ch. Engr., Savannah), is stated to have decided to extend its Columbus and Greenville line from Greenville to Newman, a distance of about 18 miles.

Carrollton, Ky.—The Carrollton & Worthville R. R. Co. is reported incorporated, with a capital of $50,000.

New Orleans, La.—Bids will be received until May 23 by the Pub. Belt R. R. Comn. (Jas. W. Porch, Secy.-Treas.), Rm. 30, City Hall, for furnishing and delivering f. o. b. cars, New Orleans, materials, including rails, angle bolts, track bolts, rail braces, pine or cypress ties, pine planking, spikes, tie plates, etc. H. Reynolds, Ch. Engr.

Needham, Mass.—It is stated that the proposed extension of the New England R. R. (C. M. Ingersoll, Ch. Engr., New Haven, Conn.) from Needham to Spring St., West Roxbury, will cost about $650,000.

Minneapolis, Minn.—The Special Council Com. appointed to consider the question of grade crossings is reported to have voted to recommend to Council for passage an ordinance drawn up by City Attorney so as to embody the plans recently prepared by City Engr. Rinker for doing away with the grade crossings in southeast Minneapolis, between the junction of the Milwaukee road with the Northern Pacific and the Short Line bridge. The plans as drawn by City Engr. Rinker contemplate the elevation of the Milwaukee tracks for a distance of about ½ mile from the Northern Pacific junction to the city limits, and also the construction of 8 bridges in place of what are now street crossings. The Northern Pacific crossing over University Ave. is also included in the general plan.

McComb, Miss.—J. T. Jones, of Gulfport, is reported to have secured possession of the Liberty-White R. R., a line running from McComb City to Liberty, a distance of about 40 miles, and will extend the line eastward from McComb to Columbia, a distance of about 50 miles. It is also reported that he is planning to build the road from Liberty to Natchez, a distance of about 75 miles.

Newark, N. J.—President Eggers, of the Bd. of Wks., is reported to have been authorized to sign an amended contract between the city and the Lackawanna R. R. Co. (Lincoln Bush, Ch. Engr., Hoboken) providing for the abolition of all grade crossings in part of city known as Section 2, extending from High St. to 1st St.

**New York, N. Y.*—The contract for the construction of the twin tunnels of the Pennsylvania R. R. under New York City in connection with its new terminals is reported to have been awarded to the United Eng. & Contr. Co., 13 Park Row. The tunnels will extend from the station on 7th and 9th Aves. 31st and 32d Sts. across the city to connect with the tunnels now under construction under the East River.

Covington, O.—Press reports state that the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) will expend about $400,000 in improvements at Covington, on the Indianapolis division. The grade crossings are to be eliminated and a second track laid.

**Pittsburg, Pa.*—The Wabash-Pittsburg Terminal Ry. Co. is reported to have awarded the contract for the concrete work of the proposed South Side elevated branch of the Wabash R. R. to the Friday Cont. Co. for $50,000.

Philadelphia, Pa.—It is stated that extensive improvements on the Philadelphia division of the Pennsylvania R. R. Co. (W. H. Brown, Ch. Engr., Philadelphia, Pa.) are to begin at once. The addition of two tracks on the Main Line between West Philadelphia and Paoli will be started within the next 60 days, and the enlarging of Broad St. Station will be commenced early in the summer.

Johnson City, Tenn.—It is stated that the Johnson City, Bakersville & Southern Ry. Co. will build from Johnson City, Tenn., to Bakersville, N. C., 40 miles, of which 22 miles will be in Tennessee. C. B. Allen, Vice-Pres., Johnson City.

Pioneer, Tenn.—The Southern R. R. Co. (W. H. Wells, Engr. of Constr., Washington, D. C.) is reported interested in the construction of a cut-off from Pioneer to Winfield, Tenn., on the Cincinnati Southern road.

Smithville, Tex.—The Missouri, Kansas & Texas R. R. Co. is reported to be considering the extension of its line from Smithville to the Coast. S. B. Fisher, Ch. Engr., Philadelphia, Pa.

**Garland, Utah.*—The Utah Constr. Co., of Ogden, is reported to have contracted with the Oregon Short Line. Co. to construct the proposed Malad Valley branch from Garland, on the main line, to Malad City, Idaho, a distance of 32 miles.

North Yakima, Wash.—The Puget Sound Eastern R. R. Co. is reported incorporated to build north from Chehalis to British Columbia and east to the Idaho line. It is stated that the only construction contemplated for the immediate future is that of a line from North Yakima, through Chehalis to tide water at Olympia. Chas. W. Taylor, of Detroit, Mich., is reported to be the promoter of the road.

PUBLIC BUILDINGS.

Notes Arranged Alphabetically by States.

Mobile, Ala.—The Bd. of Revenue and Road Comn. has adopted the recommendation of the Finance Com. that $200,000 bonds be issued for the erection of a new jail and asylum for the poor and the enlargement of the court house. The Bd. also decided to receive competitive plans for said improvements and selected Rudolph Benz, 10 N. Royal St., as consulting archt.

Little Rock, Ark.—Bids will be received May 2 by John H. Page, Secy. Bd. State Charities, for erecting a dormitory at the Deaf Mute Inst.; also fireproof connections between the buildings; Frank W. Gibb, Archt., Rm. 2, Reider Bldg.

Prescott, Ariz.—The date of opening of bids for the construction, plumbing, steam heating and electric wiring of 24 buildings at Whipple Barracks has been extended from May 12 to May 22, as advertised in The Engineering Record.

Redondo, Cal.—The City Bd. of Trus., it is stated, is considering the erection of a city hall at a cost of $20,000.

Wilmington, Del.—Wm. Draper Brinkle, Equitable Bldg., it is stated, has prepared plans for a new building for the Homeopathic Hospital, which is to be a 4-story fireproof building and is to cost about $45,000. It is stated that bids for its erection are to be received at once.

Ft. DuPont, Del.—Bids will be received by Capt. Louis F. Garrard, Q. M., U. S. A., Delaware City, May 25, for constructing an oil house at Ft. Du Pont, as advertised in The Engineering Record.

Washington, D. C.—See "Miscellaneous."

**Washington, D. C.*—John Sheehy, Ch. Engr., Bureau of Construction, National Museum, writes that the Mt. Holly Brick & Clay Co., of Harrisburg, Pa., has secured the contract for furnishing white brick for the court walls at the National Museum (bids opened Apr. 11) at $29.85 per M for headers and stretchers; $68 per M. for special quoin brick and $108 per M. for molded arch brick; total bid $12,385.

*The following are the bids received for work on the new Smithsonian Bldg.; (*a*) foundation, (*b*) drainage: E. Saxton, *a* $41,000, *b* $3,900; Brennan Constr. Co., *a* $46,250, *b* $4,950; A. R. Beall, 906 P St., N. W. (awarded contract), *a* $38,462, *b* $3,892, and Cranford Paving Co., *a* $57,500, *b* $5,600.

Washington Barracks, D. C.—Bids will be received by Capt. John Stephen Sewell, Corps Engrs., U. S. A., on May 22 for construction of from 2 to 6 double sets of N. C. officers' quarters, as advertised in The Engineering Record.

Palatka, Fla.—Plans have been submitted by H. J. Kluthro, of Jacksonville, to the Co. Comrs. for the Putnam County Court House.

Honolulu, H. I.—Bids will be received June 15 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing wharf and roadway, laundry building and plant, retaining wall and dredging at the U. S. Quarantine station, Honolulu.

Wallace, Idaho.—Stanley Fairweather, Co. Aud., writes that the citizens voted Apr. 8 to issue $75,000 bonds for a new county building.

Springfield, Ill.—The erection of a court house at a cost of about $350,000 is reported under consideration.

Danville, Ill.—It is reported that plans are being prepared for a library which is to be erected at the Danville Soldiers' Home with $25,000 donated by Andrew Carnegie.

Chicago, Ill.—Bids will be received May 2 by F. W. Blocki, Comr. Pub. Wks., for furnishing and installing in the boiler room of the city hall 4 internally fired horizontal return boilers fitted with stokers and all necessary appurtenances.

L. G. Halberg, Oxford Bldg., it is stated, is preparing plans for a 5-story fireproof hospital which is to be erected by the Swedish American Hospital Assoc. at Green and 60th Sts. at a cost of about $100,000.

Pekin, Ill.—Bids will be received May 24 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for furnishing the steam heating apparatus, complete in place, for the U. S. Post Office here.

Richmond, Ind.—The City Council, it is stated, has rejected all the bids received for the city fire department building and it is probable that the city will build the structure itself.

Crawfordsville, Ind.—Bids will be received until June

**Items marked thus give the names of parties awarded contracts.*

5 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing complete the U. S. Post-Office here.

Indianapolis, Ind.—Local press reports state that bids will be received until May 8 by the Bd. Pub. Wks. for erecting an engine house at Webb and Raymond Sts. for the South Side, to cost about $15,000.

Leon, Ia.—The erection of a new court house is reported under consideration. An election will be probably held in the fall to vote on the question.

Kingman, Kan.—The erection of a court house to cost about $40,000 is reported under consideration.

Troy, Kan.—It is reported that the Co. Comrs. intend erecting a court house at a cost of $40,000.

Ft. Riley, Kan.—Bids will be received by Capt. Leon S. Roudiez, Q. M., U. S. A., May 25, for constructing a post hospital, as advertised in The Engineering Record.

Independence, Ky.—The plans of Brown & Davis, of Cincinnati, O., it is reported, have been accepted for the Kenton Infirmary, which is to be a 3-story building of pressed brick and cost about $75,000.

Baltimore, Md.—The Bd. Pub. Improv. has approved an ordinance appropriating $25,000 for the construction of a hospital for infectious diseases.

**Marblehead, Mass.*—Richardson & Burgess, of Washington, D. C., have secured the contract for erecting the U. S. Post-Office at Marblehead, including plumbing, heating, electric wiring and conduits (bids opened Apr. 6) for $42,688.

Brockton, Mass.—W. V. Howard, City Archt., it is stated is preparing plans for the armory which is to be erected on Warren Ave. Appropriation $30,000.

**Alpena, Mich.*—It is reported that Richd. Collins has received the contract to erect the city hall of Bedford stone at about $22,921.

Kalamazoo, Mich.—Mayor Taylor and the Bd. of Fire and Police Comrs., it is stated, are advocating the erection of a combined fire station and municipal building, to cost about $100,000.

St. Paul, Minn.—The Bd. of Aldermen has appropriated $30,000 for the erection of a pavilion in Como Park.

Gulfport, Miss.—The City Council has decided to erect a city hall at a cost of $20,000 and it is stated will have plans prepared and award the contract for the erection of same at once.

Hattiesburg, Miss.—It is reported that the erection of a court house here at a cost of $50,000 is under consideration.

Farmington, Mo.—Bids will be received May 8 by the Bd. Mgrs. State Hospital No. 4 (M. G. Gresham, Secy.) for installing a hot blast system of ventilation and heating in new hospital. H. H. Hohenschild, Archt., Rolla, Mo.

Fulton, Mo.—See "Power Plants, Gas and Electricity."

Twin Bridges, Mont.—It is reported that bids will be received May 6 by the Trus. State Orphans' Home (Wiley Mountjoy, Supt.) for erecting a 2-story brick building for the lighting, heating and laundry plant.

Ft. Assinniboine, Mont.—Bids will be received May 11 by Capt. J. B. McDonald, Constructing Q. M., U. S. A., for furnishing material and constructing a basement and smokestack and installing a heating plant and plumbing system in hospital here.

**Ft. Omaha, Neb.*—Maj. M. Gray Zalinski, Constr. Q.M., Omaha, it is reported, has announced that contracts have been awarded for work at this post as follows: For construction of mess hall, stables and wagon sheds, to Peter Soderberg, Omaha, for $31,000; plumbing and heating, to J. J. Hanighen, Omaha, for $10,972, and wiring and electric lighting, to Bennett Bros., Omaha, for $1,646.

Franklin, N. H.—Bids will be received May 6 by the Bldg. Com. (Willard E. Everett, Chmn.) for erecting a Public Library; Archts., McLean & Wright, 110 Tremont St., Boston, Mass.

Concord, N. H.—It is reported that it has been decided to remodel the county court house at a cost not to exceed $35,00. The Co. Comrs. will have charge of the work.

Dover, N. H.—Taylor, Stevens & Kendall, of Boston, Mass., have been selected to prepare plans for the City Hospital; probable cost of building $40,000.

Jersey City, N. J.—Court house bonds, amounting to $150,000, it is reported, have been sold.

Brooklyn, N. Y.—Bids will be received May 11 by the Park Bd., New York City (John J. Pallas, Pres.) for erecting a shelter in Fort Greene Park, Carroll Park and Irving Sq., all in Boro. Brooklyn.

Poughkeepsie, N. Y.—The State Comn. in Lunacy at Albany, it is stated, has received bids for the construction of a tuberculosis pavilion at the Hudson River State Hospital at Poughkeepsie, as follows (bids opened Apr. 12)): Morris Kantrowitz, Albany, $29,950; Peter Keeler $34,890; Davis & Shober, Poughkeepsie, $38,000.

Buffalo, N. Y.—Bids will be received May 2 by Alonzo G. Hinckley, Clk. Bd. Superv., for erecting a mortuary building and installing an elevator in the Erie Co. Almshouse and Hospital.

A resolution has been adopted by the Bd. of Superv. authorizing the issue of $150,000 bonds for the completion of the 65th Regt. Armory.

Little Falls, N. Y.—Bids will be received by the Superv. Archt., Treas. Dept., Washington, D. C., June 1 for the construction complete of the U. S. Post Office at Little Falls, as advertised in The Engineering Record.

Raleigh, N. C.—Bids will be received May 23 by Dr. McKee, Supt. State Hospital, for erecting an annexed wing to the original building; probable cost, $40,000. W. P. Rose, Archt. Carolina Trust Bldg.

Swinburne Island, N. Y.—Bids wil be received until May 15 by the Bd. of Comrs. of Quarantine, 62 William St., N. Y. City, for construction, heating, plumbing and gas piping of 2 hospital pavilions at the Lower Quarantine Station, Swinburne Island, as advertised in The Engineering Record.

**Cincinnati, O.*—Wm. A. Hopkins, Clk. Trus. Pub. Library, writes that the contract for erecting the Corryville Carnegie Branch Library (bids opened Apr. 18) has been awarded to L. P. Hazen & Co., of Cincinnati, at $38,076, including grading, copper flashings, etc.

**Shawnee, Okla. Ter.*—Link Cowan, of Shawnee, it is reported, has received the contract to erect the city hall at $18,600.

Portland, Ore.—Bids will be received May 10 by Maj. W. C. Langfitt, Corps Engrs., U. S. A., Portland, for erecting Burrows Island Light Station, Wash.

**Retreat, Pa.*—It is reported that the contract to erect an addition to the Insane Hospital has been awarded to W. H. Sheperd & Sons, of Wilkesbarre, at $139,975.

Pittsburg, Pa.—It is reported that the erection of a $1,000,000 memorial hall to the memory of the soldiers and sailors of Allegheny County who fought in the

Bids will be received until May 10 by the Dept. Pub. Safety (Harry Moore, Dir.) for erecting an engine house at Water and Short Sts. and First Ave.

**Braddock, Pa.*—The Geo. Hogg Contracting Co., 241 Braddock Ave., it is reported, has received the contract to erect the Carnegie Library, the total cost of which is to be about $35,000.

Holidaysburg, Pa.—It is reported that a heating plant for the Blair County Court House is to be installed in a separate building from the court house at an approximate cost of $22,000.

Philadelphia, Pa.—It is stated that Cramp & Co., 1421 Filbert St., are the lowest bidders for a $60,000 addition to the Old Men's Home at Saunders Ave. and Baring St. The plans, by G. W. & W. D. Hewitt, Bullitt Bldg., provide for a 4-story dormitory containing 64 rooms and there will also be a 1-story dining-hall 25x60 ft. Both buildings will be of fireproof construction, with interiors of stone.

Allentown, Pa.—Bids will be received May 31 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing complete the U. S. Post Office here.

Arecibo, Porto Rico.—Plans and specifications are being prepared in the office of the Bureau of Public Works, Dept. of Interior of Porto Rico, for an insular jail, to be constructed at Arecibo, to cost about $35,000.

Providence, R. I.—The House has passed a bill appropriating $48,000 for the erection of a state sanatorium for consumptives.

Rockhill, S. C.—Bids will be received June 6 by Jas. Knox Taylor, Superv. Archt., Treas. Dept., Washington, D. C., for constructing complete the U. S. Post-Office here.

**Gainesville, Tex.*—J. T. Leonard, Mayor, writes that the contract for erecting a 3-story brick city hall (bids opened Apr. 20) has been awarded to R. O. Langworthy, of San Antonio, for $16,780.

Lebanon, Va.—It is stated that bids are wanted until May 8 for installing a steam or hot-water heating and plumbing outfit for the Co. Court House. L. L. Page, Co. Clk.

Lynchburg, Va.—The trustees of the George M. Jones Memorial Asso. have accepted the design of Frye & Chesterman, of this city, for the $40,000 public library to be erected here by a bequest of Geo. M. Jones. The building is to be of buff pressed brick, with Indiana limestone and terra cotta trimmings. Mrs. Jones has given a site and an endowment of $50,000. It is reported that bids for its erection are to be asked at once.

**Wheeling, W. Va.*—John Geisey, 149 15th St., it is reported, has received the contract to erect an addition to the Wheeling Hospital at a cost of about $60,000.

North Yakima, Wash.—It reported that the Co. Comrs. will consider plans on May 2 for the proposed court house, which will cost about $100,000.

**Douglas, Wyo.*—Clark Bros., of Douglas, it is stated. have received the contract to erect the court house at $19,032.

Winnipeg, Man.—It is reported that the Finance Com. of the City Council is considering the erection of a civic building at a cost of about $200,000.

Montreal Que.—See "Sewerage and Sewage Disposal."

BUSINESS BUILDINGS.

Notes Arranged Alphabetically by States.

Montgomery, Ala.—W. F. Vandiver, of Montgomery, it is stated, has purchased the Moses Bldg., on Court Sq., and it is reported, intends making improvements to the same at a cost of about $65,000.

Jas. H. Cook and Geo. Laurie, of Montgomery, it is stated, have purchased a site on N. Court St. on which it is proposed erecting a 12-story steel office building.

Hot Springs, Ark.—A 5-story semi-fireproof hotel is to be erected at Olive St. and Ouachita Ave. by D. Beitler at a probable cost of $50,000.

Long Beach, Cal.—It is reported that the citizens are agitating the erection of a hotel to cost about $500,000. W. W. Lowe may be able to give further information.

San Francisco, Cal.—Wm. H. Deming, it is stated, intends erecting a 15-story, 30x25-ft. steel office building on Grant Ave., to cost about $75,000. Hemenway & Miller, Hearst Bldg., are the archts.

*Percy J. Walker, it is reported, has received the contract for the brick work on the building of the California Electric Wks. Co., on Folsom St., at about $98,165.

Los Angeles, Cal.—John Parkinson, 606 Laughlin Bldg., it is stated, is preparing plans for an 8-story fireproof loft building to be erected by Edwin T. Earl on B'way and 4th St.

Denver, Colo.—The Denver Gas & Electric Co. (F. W. Frueauff, Secy.), it is stated, is contemplating the erection of a building, probably 8 stories high, to cost about $500,000.

August Ennerling, it is reported, has purchased a site on 14th St. and will erect a building to cost about $80,000.

**New Haven, Conn.*—David H. Clark & Co., 166 Brewery St., it is stated, has received the contract to remodel the Sanford residence on Crown St. for the Elks' Lodge, at a cost of about $28,000.

Washington, D. C.—It is reported that the members of the Royal Arcanum in the District of Columbia are contemplating the forming of a company to be known as the Royal Arcanum Bldg. Co., with a capital of $350,000, for the purpose of erecting a home for the resident and visiting members of the Order.

*A building permit has been granted to Frank A. Munsey to erect a 10-story fireproof building at 1329 E St., to be used by the Washington Times. The building is to be of steel, brick and terra cotta and to cost about $300,000. McKim, Mead & White, of New York City, are the archts., and the Geo. Fuller Constr. Co., also of N. Y. City, are the contractors.

**Tampa, Fla.*—The E. T. Mankin Co., of Richmond, Va., it is stated, has received the contract to erect a depot here for the Seaboard Air Line, at $20,000.

Chicago, Ill.—Thos. McCall, 1710 Ry. Exchange, has prepared plans for a 3-story building, 145x142 ft., to be built at Forestville Ave and 50th St. for Ramsey Hunter, at a cost of $90,000.

L. Mart Mitchell, 145 La Salle St., has prepared plans for a 3-story building, 161x75 ft., to be built at 56th St. and Michigan Ave. for Wm. T. Woodley, at a cost of $75,000.

J. S. Flizikowski, 1059 N. 41st. St., has made plans for a 3-story factory, 100x100 ft., to be erected at 41st court, near Cortland St., at a cost of $25,000, for the Ferring Co.

It is stated that a granite, brick and terra cotta bank building is to be erected for the American Trust & Savings Bank Co. at Clark and Monroe Sts. Probable cost $1,500,000.

Ludwig Novy, 1618 W. 22d St., is preparing plans for a store and flat building to be built at Oakley Ave. and 25th St. It will be 3-story, 24x128 ft., of pressed brick, and will cost $20,000.

**Moline, Ill.*—Peter Peterson, 1209 12th Ave., it is reported, has received the contract to erect the exchange building for the Central Union Telephone Co., which is to cost about $20,000.

Springfield, Ill.—Johnston & Hatcher, it is stated, are considering plans for a 4-story building which they propose erecting at 7th and Adams Sts.

Anderson, Ind.—The aerie of Eagles, it is stateu, are planning to erect a lodge building to cost about $20,000.

Muncie, Ind.—Arthur W. Brady, Pres. of the Indiana Union Traction Co., Anderson, it is stated, has announced that plans are being prepared for a terminal station which is to be erected in this city on Charles, Howard and Mulberry Sts., at a cost of about $50,000.

Greenfield, Ind.—It is reported that the National Shut-in Society (J. M. Thompson, Pres.) will erect a home in this city to cost about $100,000.

Des Moines, Ia.—All bids received for erecting the Garver Bldg., on Locust and 7th Sts., have been rejected. J. E. Tusant submitted the lowest bid at $35,079. Proudfoot & Bird, Archts., Crocker Bldg.

**Rockwell City, Ia.*—Chas. Timeon, of Perry, Ia., it is reported, has received the contract to erect the Security Bank Bldg., at a cost of about $30,000.

Sioux City, Ia.—John F. Lessenich, present owner of the Chicago House, it is stated, intends erecting on said site at 4th and Jones Sts. a new hotel to cost about $100,000.

**Mt. Pleasant, Ia.*—Whitney, Bergdahl & Hardy, it is reported, have received the general contract for the Y. M. C. A. building, at a cost of about $51,104.

New Orleans, La.—S. V. Fornaris, it is stated, has purchased a site at University Pl. and Canal St., on which he proposes erecting a hotel to cost about $500,000.

New Orleans, La.—It is stated that a building permit has been granted to D. H. Holmes Co. to erect a 4-story brick building on Iberville St., at a cost of $30,000.

**Baltimore, Md.*—The Noel Constr. Co., it is reported, has received the contract to erect a 6-story building for the Singer Mfg. Co., at 109 W. Lexington St., at a cost of about $70,000.

The Hubbard Fertilizer Co. (Howard Hubbard, Secy.) proposes improving its plant at 5th Ave. and Clinton St., Canton, consisting of tearing away the present pier and building a new bulkhead, 100 ft. from present one, and filling same in so as to make new land, 100 ft. x 100 ft., which will be piled, and upon which there will be erected a new storage building, 2 stories high, 100 ft. x 100 ft. From this new building there will be constructed a new pier 30 ft. x 250 ft. long, upon which will be constructed another building 2 stories high. No new machinery required.

Durand, Mich.—It is reported that the Grand Trunk Union Station, which was destroyed by fire on Apr. 16, is to be rebuilt at once. T. T. Irving, Resident Engr., Detroit, Mich.

Ironwood, Mich.—It is reported that Geo. A. Curry is arranging to erect a $35,000 opera house here.

Corinth, Miss.—Bids are wanted at once by the Alcorn Woolen Mfg. Co. (P. T. Jones, Jr., Treas.) for erecting a factory, concrete construction.

St. Paul, Minn.—The Ramsey County Medical Society ((Ethelbert W. Geer, Pres.), it is stated, contemplates erecting a headquarters building for the medical and scientific interests of the northwest, which is to cost about $100,000.

**Hattiesburg, Miss.*—W. M. Allen, of Peoria, Il., it stated, has received the contract to erect the Gulf & Ship Island Hotel, which is estimated to cost $300,000.

St. Louis, Mo.—It is reported that the mgrs. of the Women's Christian Assoc. are considering the erection of a building to cost about $200,000.

**Hannibal, Mo.*—It is reported that the contract to erect the Mark Twain Hotel has been awarded to Buergen & Kaemper, of Quincy, Ill., at about $61,000.

Joplin, Mo.—It is stated that bids are wanted May 10 by T. R. Bellas, Archt., 19 Columbia Bldg., for erecting a 6-story hotel, store and office building, 89x120 ft., for L. P. Cunningham. Estimated cost $100,000.

**Kansas City, Mo.*—The contract for a 4-story store building, 48x111 ft., for L. W. Besse, of Springfield, Mass., has been awarded to Hollinger & Mitchell, of Kansas City. B. Hammett Seabury, Archt., Springfield, Mass.

Nashua, N. H.—The Nashua Bldg. Co. has secured the contract for a dye-house and bleachery for the

Items marked thus give the names of parties awarded contracts.

Nashua Mfg. Co., of Nashua. Building to be 362x75 ft., 2 stories and basement, brick mill construction.

Orange, N. J.—It is stated that contracts have been awarded as follows for erecting a club house for the Woman's Club Realty Co., of Orange, the total cost of which is to be about $42,000: Miller & Co., mason work; Fred Kilgus, carpenter work; Jaehnig & Peoples, plumbing; John L. Reed, heater, and S. J. Blair, of East Orange, the slate roofing. Bidders of Newark unless otherwise stated.

Newark, N. J.—A building permit has been granted to Wm. S. Chardavoyne, owner, to erect a 7-story office building at 462 Broad St.; cost $30,000.

Simon Heyman, it is stated, has purchased the building at 77 Market St., and intends making improvements at a cost of about $20,000.

Rochester, N. Y.—It is stated that plans have been completed for a 5-story office building to be erected by the Buffalo, Rochester & Pittsburg Ry. Co. (J. M. Floesch, Ch. Engr., Rochester), on Washington St., at a cost of $250,000.

**Cincinnati, O.*—Stanley Ferguson, Ingalls Blk., Secy. Cincinnati Southern Ry. Co., writes that the contract for erecting a concrete freight station was on Apr. 17 awarded to the Collier Bridge Co., 82 Baldwin Blk., Indianapolis, Ind.; cost reported to be $191,165.

Saml. Hannaford & Sons, Hulbert Blk., it is stated, have been engaged to prepare plans for the $300,000 building which is to be erected at 4th and Main Sts. for the Citizens' Natl. Bank.

The Alms & Doepke Co., it is reported, has purchased buildings on Sycamore, Canal and Hunt Sts., and intends making improvements at a cost of about $400,000.

Cleveland, O.—X. X. Crum, it is stated, is planning to erect a family hotel at Kensington St. and Euclid Ave., to cost about $100,000.

Geo. F. Hammond, Archt., 166 Euclid Ave., it is stated, has filed plans for a 10-story addition to the Hollenden Hotel which is to be of brick and cost about $28,000.

Nelsonville, O.—Bids will be received May 5 by the Bldg. Com. for erecting a 3-story brick building 50x100 ft., for Valley Lodge No. 169, Knights of Pythias; address Lee McDowell, Nelsonville. B. F. Matthews, Archt., Lima.

Van Wert, O.—W. W. Wachter, of Toledo, O., it is stated, is the archt. for a $60,000 building which is to be erected by the Home Guards of America.

**Homestead, Pa.*—Bodine & Co., it is stated, have secured from Jacob Klein, of Penn Ave., the contract to erect a banking and business building to cost about $35,000.

Tarentum, Pa.—It is stated that a 2-story brick theater is to be erected here at a cost of $40,000.

McKeesport, Pa.—It is reported that John P. Harris contemplates erecting a theatre in this city at a cost of about $65,000.

The Directors of the First Natl. Bank, it is stated, have had plans prepared for a building to replace the structure on 5th Ave. and Walnut St., which is to cost about $200,000.

Philadelphia, Pa.—See "Railroads."

**Philadelphia, Pa.*—A building permit has been granted to Harry Brocklehurst, 512 Norris St., to erect a 4-story brick warehouse at American and Diamond Sts., at a cost of $28,000.

The Pennsylvania R. R. Co. has secured a permit to erect an extension to an engine house in the yard between 48th and 49th Sts., at a cost of $40,502.

Memphis, Tenn.—Alsup & Wood, Randolph Bldg., it is reported, are preparing plans for the Anne Brinkley Home, which is to be erected by the Women's Christian Assoc. at a cost of about $40,000.

Knoxville, Tenn.—Richards Bros., owners of the Oliver Springs Hotel which was destroyed by fire recently, intend erecting a brick structure.

Waco, Tex.—Bids will be received May 4 by Pearson & Green, Archts., for furnishing material and erecting, including excavation, a Y. M. C. A. bldg. O. L. Halbert, Chmn. Bldg. Com.

Mineral Wells, Tex.—Bids will be received by W. G. Cain, Tyler, for erecting a brick store building, 26x92 ft., at Mineral Wells.

Salt Lake City, Utah.—It is reported that a depot is to be erected here at a cost of $200,000 in which the Oregon Short Line R. R. Co. (W. H. Bancroft, Gen. Mgr., Salt Lake City) is interested.

North Yakima, Wash.—The erection of a Y. M. C. A. bldg. at a cost of $20,000 is reported under consideration.

Seattle, Wash.—Adolph Busch, Pres. of the Anheuser-Busch Brewing Co., of St. Louis, it is stated, has announced that he intends erecting a building here to be either 12 or 16 stories high.

Spokane, Wash.—Archt. John K. Dow, of Spokane, writes that bids will be received about Aug. 1 for the erection of a Y. M. C. A. bldg. to cost about $80,000.

Vancouver, B. C.—It is reported that a 7-story building is to be erected at Hastings and Abbott Sts. by L. G. Wing, to be used as a theatre and hotel and to cost about $100,000.

**Brandon, Man.*—Chas. Hall, it is stated, has received the contract for erecting the Y. M. C. A. bldg., including heating and plumbing, at $55,677.

CHURCHES AND DWELLINGS.

Notes Arranged Alphabetically by States.

Little Rock, Ark.—The congregation of the Second Baptist Church, it is stated, has adopted the report of the Bldg. Com. (J. H. Bilheimer, Chmn.) recommending the site at 8th and Scott Sts. for the proposed $50,000 edifice.

Jacksonville, Fla.—Father Maher, it is stated, is considering the erection of a new edifice at Newnan and Duval Sts., at a cost of about $75,000.

Atlanta, Ga.—A building permit has been granted to Edw. Durant to erect an apartment house on Peachtree St. and North Ave. at a cost of about $25,000. Butt & Morris, Century Bldg., are the Archts.

Rogers Park, Ill.—J. E. O. Pridmore, Champlain Bldg., Chicago, it is stated, has prepared plans for an edifice for the Congregational Church which is to be erected at Ashland and Morse Aves. at a cost of about $75,000. It will be of brick with Bedford stone trimming, 80x135 ft.

Champaign, Ill.—The Trus. of the First M. E. Church, it is stated, have decided to erect a new edifice at a cost of $50,000.

Chicago, Ill.—Henry J. Schlacks, Borden Blk., has prepared plans for a convent building to be built at Hermitage Ave. and Clybourn Pl. for the Sisters of the Resurrection. It will be a 4-story structure 48x80 ft. and cost $25,000.

J. S. Flizikowski, 1059 N. 41st. St., has prepared plans for a church and school to be erected in Hegewisch for a R. C. congregation of which Father Chodniewicz is pastor. The building will be 2 stories, 54x108 ft., and will cost $25,000.

Streator, Ill.—Jos. Molitor, of Chicago, has prepared plans for a church to be built for St. Stephen's R. C. congregation. The building is to be 68x130 ft., of brick and stone, and cost $30,000.

Des Moines, Ia.—Plans have been completed for an apartment house to be erected at 10th and High Sts. by J. M. McNamara at an estimated cost of $50,000.

Holyoke, Mass.—Louis A. LaFrance, 400 High St., it is reported, has received the contract to erect a 5-story tenement house on S. Bridge St. to cost about $30,000.

St. Paul, Minn.—Chas. S. and John S. Pillsbury, it is stated, have given to Plymouth Church $40,000 to erect a new home for the Bethel Settlement work, the building to be a memorial to their father and mother.

St. Louis, Mo.—It is reported that the members of the Pilgrim Congregation Church have purchased a site at Union and Kensington Aves. and intend erecting an edifice at a cost of $150,000. Address Bd. Trus.

Newark, N. J.—A building permit has been granted to McManus Bros., owners, for erecting a 4-story brick dwelling at Howard St. and Springfield Ave.; estimated cost, $26,796.

Harrison, N. J.—Jos. Kennedy, of Kearny, it is stated, has completed plans for a rectory which is to be erected for the Church of the Holy Cross at a cost of about $25,000.

Massillon, O.—It is reported that a stone Presbyterian Church is to be erected at a cost of $40,000.

**Zanesville, O.*—It is reported that Dunsweild Bros. have received the contract to erect an edifice for the Emanuel Baptist Church at $31,894.

Latrobe, Pa.—Thos. Reilly, of Philadelphia, it is stated, has received the contract to erect an edifice for the Church of the Holy Family at a cost of about $66,000.

Manning, S. C.—Bids will be received by the Bldg. Com. (W. Scott Harvin, Chmn.) May 5 for erecting a brick Presbyterian church. J. H. Sams, Archt., Columbia, S. C.

Brownsville, Tex.—M. Hanson, Jr., of Brownsville, it is stated, has received the contract for the foundation of the Methodist Church at about $35,000.

Ft. Worth, Tex.—It is reported that Dr. W. A. Duringer has purchased a site on Hill St. and will erect a residence at a cost of $20,000.

Lewisville, Tex.—Bids are wanted May 5 for erecting a 1-story brick church, 38x66 ft.; address, E. J. Farrington.

**Seattle, Wash.*—J. L. Cannon, of Seattle, it is reported, has received the contract to erect the Cathedral at 9th Ave. and Marion St., exclusive of plumbing, wiring, heating, etc., at $164,962. The plumbing, wiring, etc., it is estimated, will cost an additional $35,000.

Wheeling, W. Va.—The W. W. Woods Co., 33d and Chaplin Sts., it is reported, has received the contract to erect an apartment house for L. A. Rolf at 13th St. at about $50,000.

Janesville, Wis.—It is reported that bids are wanted May 2 for erecting an edifice for the Cargill Memorial M. E. Church, work to include masonry, carpentry, structural iron work, plumbing, steam heating, etc.; T. E. Bennison, Pastor.

Rosthern, Sask, N. W. Ter.—The plans of Brielmaier & Sons, of Milwaukee, Wis., it is stated, have been accepted for the St. Peter's monastery which is to be erected at a cost of about $1,000,000.

SCHOOLS.

Notes Arranged Alphabetically by States.

Anniston, Ala.—Bids will be received until May 5 by John B. Knox, Anniston, for erecting the Alabama Presbyterian College. Probable cost $75,000. Address communications to Rev. Wm. E. McIlwain, Anniston.

Birmingham, Ala.—B. F. Barbour Plumbing & Electric Co., 2010 3d Ave., it is stated, submitted the lowest bid for installing the electric wiring, plumbing and steam heating in the High School at $21,711.

Alaska.—It is reported that all bids recently received for erecting schools in Alaska have been rejected as they exceeded the appropriation which is $60,000. It is stated that bids are again to be received.

Los Angeles, Cal.—It is reported that a $30,000 school is to be erected at Euclid and Stephenson Aves.

Washington, D. C.—See "Power Plants, Gas and Electricity."

Duncan, Ind. Ter.—Bids will be received May 5 by the School Bd., for erecting a stone or brick school; probable cost, $18,000.

Evanston, Ill.—The citizens, it is reported, have voted in favor of issuing $55,000 bonds to erect a new Dewey school.

Morgan Park, Ill.—H. P. Beers, 218 La Salle St., Chicago, it is reported has prepared plans for a high school to be erected for the Bd. of Educ. of Thornton Township at a cost of $25,000.

Moores Hill, Ind.—The Educational Com. of the Moores Hill College, it is stated, is contemplating the erection of a new administration building at the College at a cost of $40,000.

Farmersburg, Ind.—The plans of Gault & Gault, of Vincennes, it is reported, have been accepted for the 2-story brick high school which is to be erected here.

Corydon, Ia.—School bonds amounting to $15,000 have been sold. A high school is to be erected at once to cost about $15,000.

Des Moines, Ia.—The erection of a Bible College Bldg. at Drake Univ., to cost about $25,000, is reported under consideration.

Danville, Ky.—It is reported that improvements are to be made at Central Univ. at a cost of about $80,000. $30,000 has been given by Andrew Carnegie and it is proposed by the citizens to raise $50,000 additional for the improvements.

Donaldsonville, La.—The erection of a high school at a cost of $25,000 is reported under consideration.

Plainville, Mass.—At the town meeting held recently the sum of $21,000 was appropriated for the erection of a school. H. E. Thompson is a member of the Bldg. Com. having the matter in charge.

Beverly, Mass.—The erection of a school at a cost of $65,000 is reported under consideration.

Pontiac, Mich.—School bonds amounting to $25,000 have been sold.

Port Huron, Mich.—The Bd. of Educ. is said to be contemplating the erection of a school at a cost of $20,000.

Ishpeming, Mich.—It is reported that the proposition to issue $20,000 school bonds carried.

**Winona, Minn.*—The School Com. of the St. Stanislaus Polish Catholic Church, it is reported, has awarded the contract for the carpenter work on the parochial school which is to be erected at Carimonia and 5th Sts. to Seidletz & Werner, of Winona, at $14,010 and the contract for the masonry to Harders & Gatz, of Winona, at $14,335.

South St. Paul, Minn.—The plans of Arthur Elliott, of South St. Paul, it is stated, have been accepted for a $30,000 school.

**St. Paul, Minn.*—Ries & Co., 918 Thomas St., it is stated, have received the contract to erect a 4-room addition to the Hancock School at $16,491.

Bids will be received May 8 by the Bd. Educ. (Chas. W. Clark, Secy.) for $25,000 school bonds.

Minneapolis, Minn.—The Bd. of Educ., it is stated, has decided to erect a 4-room annex to the Horace Mann School, which together with the heating plant is to cost about $25,000. E. S. Stebbins, Masonic Temple, is the archt. The Bd. has also decided to erect a 4-room school in the dist. between Longfellow and Minnehaha Schools.

St. Louis, Mo.—The following are reported to be the lowest bids received Apr. 7 for school improvements: Clinton school addition—General work, E. C. Gerhard Bld. Co., $55,111; plumbing, John J. Fry, $5,515; heating, E. P. Ambler, $12,457. McKinley High School addition—General work, Fred Boeke, $45,630; plumbing, P. C. Ring, $697. L'Ouverture addition—General work. F. W. Hackett, $59,489; plumbing, Crane-Clancy Plumbing Co. and G. F. Meyer bid the same, $5,200; heating, Haynes-Langenberg Mfg. Co., $14,500.

It is stated that a 2-story brick $40,000 school is to be erected by St. Peter and Paul's Parish at 81 Allen Ave.

The Sisters of St. Francis, it is reported, intend erecting a convent and school at 3606 Blair Ave. at a cost of $26,000.

Kearny, N. J.—Jos. Kennedy, 8 Kearney Ave., it is stated, has prepared plans for a parochial school to be erected by St. Cecilia's R. C. Church on Chestnut St. The building is to be of brick and is to cost about $50,000.

Harrison, N. J.—The following are reported to be the lowest bids received on various parts of the work in connection with the erection of the school on Cross St.: Carpenter work, Patrick McGlennon, $13,750; mason work, Albert Strodling, $15,133; ventilating and steam heating, John G. Keller & Co., $3,487; plumbing, John T. Lynch, $1,725; electric wiring, W. Brown Son Co., $427.

**West Orange, N. J.*—The following contracts, it is reported, have been awarded for erecting the First Ward School: Carpenter work, Frye & Porter, $18,596; mason work, Chas. E. Dodd Co., $18,547; plumbing, Bauer Bros., $1,809; heating, L. W. Butterfield, $5,181.

New York, N. Y.—The following are the bids opened on Apr. 24 by the Bd. of Trus. of the College of the City of New York for work in connection with the construction of the buildings for the College at 140th St. and Amsterdam Ave.:

Mason, iron, marble, carpenter, electric and other work: Thos. Dwyer, 140th St. and Amsterdam Ave., $880,660; Louis Wechsler, $989,000; Chas. W. Gilpin, $938,000; and V. J. Hedden Sons & Co., 143 Liberty St., $888,776.

Ventilating and heating: Gillis & Geoghegan, 537 W. Bway., $229,200; Blake & Williams, $285,418; United Htg. Co., $252,421; E. Rutzler Co., $264,275, and Geo. A. Suter Co., 112 Wooster St., $243,000.

Plumbing: Wm. Hill & Sons, 618 6th Ave., $95,432; Jas. P. Knight, $101,300; W. H. Spellman, 112 W. 38th St., $93,870; Thos. T. Byrne, $107,432, and John Tucker, $119,037.

Bids will be received May 8 by C. B. J. Snyder, Supt. School Bldgs., for erecting 3 outside iron stairs at School No. 23; also for installing ventilating and heating apparatus in School No. 63; both in Boro. Manhattan.

**Brooklyn, N. Y.*—The following are the bids opened on Apr. 17 by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for general construction of additions and alterations: (*a*) Teachers' Training School, (*b*) School No. 27, both in Brooklyn Boro.: John Auer & Sons, *a* $290,470; Richard E. Heningham, *a* $274,327; Geo. Hildebrand, *a* $269,539; *b* $70,844; John Thatcher & Son, *a* $273,792; Chas. H. Peckworth, *a* $281,743; Juan B. Arci, 192a S. 9th St., *a* $268,000 (awarded contract); Wm. Werner, *b* $72,735; Geo. F. Driscoll, *b* $73,951; Laurence J. Rice, *b* $86,889; Tolmie & Kerr, *b* $71,387; Guidone & Galardi, *b* $71,400 and John Thatcher & Son, 54 Park Ave., *b* $63,300 (awarded contract).

*Bids were opened same time and place for sanitary work and gas fitting of Commercial High School, Brooklyn Boro.: Wm. C. Ormond, $43,900; Dowdeswell Bros., $47,349; Rossman & Bracken Co., $37,850; W. H. Spelman, $39,964, and Jas. Harley, 288 Flatbush Ave., $32,711 (contract awarded).

Bids will be received May 8 by C. B. J. Snyder, Supt. School Bldgs.; N. Y. City, for installing ventilating and heating apparatus in addition to School No. 27; also for plumbing at Manual Training High School, Boro. Brooklyn.

Jamaica, L. I., N. Y.—Bids will be received by C. B. J. Snyder, Supt. School Bldgs., N. Y. City, for installing ventilating and heating apparatus in School No. 82, Jamaica, Boro. Queens.

Buffalo, N. Y.—Bids will be received by the Bd. Pub. Wks. (Francis G. Ward, Comr.) until May 3, for erecting a 10-room brick school in Dist. No. 7. Separate bids to be received on the following: Masonry, cut-stone, iron work, plastering, etc.; carpentry, electrical work, etc.; roofing, metal work, steel ceilings, etc.; ventilating, heating, etc.; plumbing, gas fitting, etc.

The Common Council has adopted a resolution authorizing the Comr. of Pub. Wks. to prepare plans and receive bids for erecting a 24-room school on Jefferson and Sycamore Sts.

Syracuse, N. Y.—A bill has passed the Assembly authorizing the erection of a high school here.

Amsterdam, N. Y.—Governor Higgins has signed a bill authorizing the issue of $106,600 bonds for the purpose of acquiring sites and erecting schools here.

Gloversville, N. Y.—It is stated that plans have been accepted for a $100,000 high school.

**Ithaca, N. Y.*—Norris Kantrowitz, of Albany, it is stated, has received the contracts for erecting buildings at the College of Agriculture at Cornell Univ. at $177,700.

**Fargo, N. D.*—The Trus. of the Agricultural College, it is stated, have awarded the contract for the erection of a chemical laboratory to Bowers Bros. and the contract for plumbing and heating to Edw. J. Harrington, at an aggregate cost of $43,000. Contractors of Fargo.

**Mayville, N. D.*—Johnson & Powers, of Fargo it is stated, have received the contract to erect a wing to the normal school here at $41,700 and Rowe & Parr, of Mayville, the contract for the plumbing and heating of same at $5,200.

Lorain, O.—H. O. Wurmser, of Lorain, it is stated, has prepared plans for a $35,000 school to be erected in South Lorain, and it is stated will ask bids at once for its erection.

Marion, O.—It is reported that the Bd. of Educ. has decided to issue $60,000 bonds to erect 2 schools.

**Granville, O.*—It is reported that Wm. C. Handshy, of Zanesville, has received the contract to erect a dormitory on the campus of Shepardson College at $24,833 and also the contract for a gymnasium at $11,700.

Bedford, O.—The proposition to issue $20,000 school bonds, it is reported, has carried.

Brooklyn, O.—Bids will be received May 20 by J. F. Schnabel, Clk. Bd. Educ., of South Brooklyn, P. O., Brooklyn, for furnishing materials and erecting a 6-room brick and stone addition to the present Dawning St. School. Bids on material and labor to be stated separately; Geo. F. Hammond, Archt., 166 Euclid Ave., Cleveland.

Bedford, O.—The citizens have voted in favor of issuing $20,000 school bonds.

Cleveland, O.—The Bd. of Educ. has authorized the issue of $300,000 bonds for improving the schools.

Allegheny, Pa.—The School Bd. is considering plans for a new school which will probably be erected on Park View Ave.

South Bethlehem, Pa.—A 3-story $80,000 building is to be erected at Lehigh Univ. in memory of Dr. Thos. Messinger Drown, late pres. of the inst., and is to be known as the Drown Memorial Hall.

Philadelphia, Pa.—It is reported that a site has been selected on which it is proposed erecting an annex to the Catholic High School for Boys at Vine and Broad Sts.

Trafford City, Pa.—Bids will be received until May 8 at the office of Rieger & Currier, Archts., 314 4th Ave., Pittsburg, for erecting a brick school here.

Pittsburg, Pa.—Bids will be received May 4 by David Bisset, Secy., for erecting an addition to the Cargo School, Boggs Ave., 32d Ward; plans, etc., may be secured from Thos. C. Cook, Archt., 219 Sycamore St.

The Bd. Trus. of the Western Theological Seminary, it is stated, has accepted the plans of T. E. Billquist, Stevenson Bldg., for the erection of a $500,000 structure to take the place of the present building. No site has been selected as yet for the new building. Rev. David Gregg, Pres.

Bristol, R. I.—A site has been selected bounded by Church, High and Court Sts. and Narragansett Ave. on which it is proposed to erect the Colt High School for the erection of which $40,000 has been given by Col. Saml. P. Colt.

Nashville, Tenn.—It is reported that the main building at the Vanderbilt Univ. which was destroyed by fire on Apr. 20 is to be rebuilt, and that plans will be perfected at the next meeting of the Bd. of Trus.

Nashville, Tenn.—A bill has passed third reading in the City Council appropriating $14,000 for the erection of a school in the 14th Ward.

Ft. Worth, Tex.—The School Bd. of the City of North Ft. Worth, it is stated, has adopted plans for a $20,000 school to be erected in place of the structure formerly at Main, 20th and 14th Sts., which was destroyed by fire.

San Angelo, Tex.—It is stated that the Attorney General has approved the $20,000 school improvement bonds.

Bay City, Tex.—The citizens voted Apr. 12 to issue $21,000 bonds for the erection of a brick school.

**Houston, Tex.*—Rocke & Smith, it is stated, have received the contract to erect the Fifth Ward School at $19,212.

Great Barrington, Vt.—A site has been selected on which it is proposed erecting a school to cost $20,000.

La Crosse, Wis.—It is stated that the City Council has authorized the issue of $100,000 bonds for the immediate construction of a high school.

**North Yakima, Wash.*—W. W. Felton, of North Yakima, it is stated, has received the contract to erect a school on N. Naches Ave. at about $20,000.

Everett, Wash.—The Trus. of the United Lutheran Societies, it is reported, have decided to erect a college here at a cost of about $40,000. E. A. Erickson, Trus., Bellingham.

Seattle, Wash.—The Adelphia College Education Society, it is reported, has filed articles of incorporation for the purpose of erecting an institution here to be known as the Adelphia College. It is stated to be the purpose of the incorporators to spend between $50,000 and $100,000. Andrew Chillberg is to be a member of the Bd. of Trus.

Two Rivers, Wis.—It is stated that a school is to be erected here at a cost of $60,000.

Ottawa, Ont.—The Bldg. Com. of the Pub. School Bd., it is stated, has authorized the Bldg. Inspector to prepare plans for the Central Ward School, which is to cost about $40,000, and also for an addition to Archibald St. School, to cost $20,000.

STREET CLEANING AND GARBAGE DISPOSAL.

Notes Arranged Alphabetically by States.

Lockport, N. Y.—The Bd. of Health is reported to have under consideration the establishment of a new garbage collection and disposal system.

**Rome, N. Y.*—Hyde & Hyde are reported to have secured the combination contract for street cleaning during the coming season, taking care of ashes, rubbish, cleaning out catch basins, taking care of parks and operating snow plows in winter, etc., for $39,000 for 3 yrs.

Washington, Pa.—The Council is reported to have under consideration the construction of a garbage furnace.

Montreal, Que.—See "Sewerage and Sewage Disposal."

NEW INDUSTRIAL PLANTS.

See also Business Buildings.

Wm. Saile, 2237 Fontain St., Philadelphia, Pa., is in the market for several pumps for a glue works. These pumps are to convey wet hide pieces from washers to piles 100 to 300 ft. away, the piles being about 20 ft. high. The hides when wet are very soft and average in size ¼ in. thick and 4 ft. square, and it is desired to get some sort of a dredging pump which will handle the water with these hides.

The Dennis-Simmons Lumber Co., Elm City, N. C., will build a mill at Kenly, N. C., next year, but the capacity has not yet been decided.

The Geo. D. Pohl Mfg. Co., Vernon, N. Y., will add about 5,000 sq. ft. floor space to its plant, so as to enable it to build larger gas engines. The present equipment limits the size to about 60 h.p., and with the enlargement of the plant the company will be able to build 300-h.p. engines.

The Briner-Pogue Mfg. Co., 204-208 Franklin Ave., St. Louis, Mo., expects to install machinery and tools for the manufacture of electrical supplies.

The Kanasket Lumber & Shingle Co., Tacoma, Wash., writes that it has not yet completed plans for the erection of its new plant.

The Owen-Arnold Co., Allegan, Mich., casket manufacturer, is erecting a 2-story building, 50 ft. square, of hollow cement blocks. The company is in the market for a 15-hp. single-phase, alternating-current electric motor and steam-heating equipment for the building and dry kiln.

Joseph Hyde Pratt, Chapel Hill, N. C., writes that he has recently obtained a charter for the Chapel Hill Construction & Supply Co., and will erect a woodworking plant which will have an initial power plant installation of about 30 hp. It is proposed to later begin the manufacture of furniture and brick, and to erect an ice plant.

The Kaysville, Utah, Milling Co. has been organized and will erect a 100-bbl. flour mill and a 20,000 to 30,000 bu. elevator.

The W. F. Green Lumber Co., Leaf, Miss., is erecting a plant with a capacity of 60,000 ft. daily.

F. P. Stearns, Fredericksburg, Va., desires information regarding machinery for manufacturing tinware. He already has the power plant.

The Imperial Paper Mills, Ltd., Sturgeon Falls, Ont., is erecting a plant to have an approximate capacity of 70 tons. There will be a 74x75-ft. digester building 100 ft. high, and a 35x172-ft. building 30 ft. high, for storage, acid plant, etc.

The Savannah, Ga., Stationery & Printing Co. expects to add to the plant of the Vaisberg Printing Co., which is owned by the company.

The U. S. Engineering Co., P. O. Box 152, Aurora, Ill., desires catalogues and discount sheets from manufacturers of machinery and supplies.

The Transue & Williams Co., Alliance, O., is building a 75x52-ft. addition to enlarge its machine and die-sinking department.

The Norton Iron Works, Ashland, Ky., are making extensive repairs to their blast furnace, including the installation of two new blowing engines, three hot-blast stoves, central condensing plant and 2,100 hp. water-tube boilers.

The Montreal Steel Works, Ltd., Montreal, Can., are enlarging their steel casting plant and expect that it will be one of the best equipped on the continent.

The E. R. Wagner Mfg. Co., North Milwaukee, Wis., which manufactures vehicle hardware, etc., is planning a large addition to its factory, to be of strictly fireproof construction.

The Bowersock Milling Co., Lawrence, Kan., has begun the erection of a 500-bbl. flour mill and intends to install a 300 or 350 kw. generator.

The Worcester, Mass., Pressed Steel Co. will erect a new building on a 6-acre lot recently purchased at Barber's Crossing. The building will probably be 2 stories, 90x216 ft., with gallery construction, monitor roof, and a 30-ft. central bay covered by a 2-ton electric traveling crane. The factory will probably be built by day work. The company will require new annealing furnace, rolling mill for cold rolling steel, 15 in. wide, sheet shears, trolley track, new presses, 150-hp. steam or gas engine plant and many motors.

Will Ellebracht, Mason, Tex., will install a 6 to 10-ton ice plant for the summer of 1906.

Hill & Bosley, Winchendon, Mass., contemplate erecting a 120x48-ft. building to be used as a foundry. A 15-hp. gasoline engine will be installed.

C. H. Ely, 520 Madison St., Sandusky, O., writes that the Ely Window Glass Co. has been organized to erect a 24-blower tank at Independence, Kan.

The Dazey-Moore Grain Co., Ft. Worth, Tex., expects to soon begin the erection of a warehouse and grain elevator. Electric power or a gasoline engine will be used.

The Northwestern Lithographing Co., Milwaukee, Wis., will erect a concrete factory building to cost about $45,000, according to local press reports. It is stated that the additional machinery to be installed will include new electric motors.

The Marshall Furniture Co., Lestershire, N. Y., will erect a 4-story addition to its plant, 100 ft. long, according to local press reports.

The German Arch Stone Brick Co., Baltimore, Md., has been incorporated with a capital of $100,000 and will erect a plant, according to local newspaper reports. Henry Yewell Bready is interested in the company.

A New York syndicate has been securing lead and zinc property in Hardin Co., Ill., with a view to extensive operations. Two air compressors will be needed. Prof. J. F. Elsom, New Albany, Ind., is consulting chemist.

Cramp & Co., Philadelphia, Pa., have been awarded a contract by Ballinger & Perrot, archts., for a $100,000 plant for the Crane Co., according to local press reports.

Geo. C. Dietrick,* Philadelphia, Pa., was granted a permit for an ordnance machine shop for the Midvale Steel Co., at Blabon Ave., and the Reading Ry., according to local press reports. The building will be of brick and structural steel on concrete foundations, embracing an area of 548x152 ft., and will cost $225,000.

The Philadelphia, Pa., Ship Repair Co. has taken title to a plot of ground comprising about 8½ acres on the Delaware River front, on which the company's dry dock, machine shops and an office building will be erected, according to local newspaper reports.

The Evansville, Ind., Foundry Assoc. has incorporated with a capital stock of $100,000. The company will build a foundry. Fred Eggert and C. F. Dickman, directors.

The Chalmette Laundry Co., New Orelans, La., will erect a building at the corner of Tulane Ave. and White St., to cost something like $100,000, according to local press reports. The plant will be run electrically and it is stated that at least $30,000 worth of new machinery will be installed.

Joseph H. Bromley, Philadelphia, Pa., has let contracts for a $2,000,000 lace mill at 22d St. and Lehigh Ave., according to local press reports. It is stated that contract for the erection of the building has been let to Wm. Steele & Sons.

The Webb Press Co., Ltd., Minden, La., expects to erect a dozen or more large cotton presses in the South this year.

The Muskegon, Mich., Boiler Works will erect a building which will require a ground space of approximately 80x240 ft., so arranged that it can be added to as required. The shop consists of a 50x200-ft. main erecting floor, which will be served with a 10-ton electric traveling crane with a 3½ton auxiliary hoist. Off this erectng floor will be the machine bay, stock bay, riveter tower and blacksmith shop. The machine and stock floor will be served by a number of 3½-ton hand traveling cranes. The blacksmith shop will be served by two hand-traveling cranes, one of 3½ tons capacity and one of 1½ tons capacity, the runways of these cranes so arranged that the cranes will run out over the main floor, enabling material to be handled from the flange fires to the hammers, etc. The engine room will contain a 100 hp. engine, a large hydraulic pump, generator, switchboards, etc.

MISCELLANEOUS.

Notes Arranged Alphabetically by States.

Coronado, Cal.—Andrew Ernst, City Engr., writes that the city will probably construct a sea wall, but the matter of issuing bonds for the work has not yet been voted upon.

Waterbury, Conn.—The House is reported to have passed a bill authorizing this city to issue $250,000 bonds for a public park system.

Washington, D. C.—Bids will be received May 4 by Capt. G. W. Baird, U. S. N., Supt. State, War and Navy Dept. Bldg., for furnishing hydraulic elevators and heating boilers.

Washington, D. C.—Bids will be received May 3 by E. A. Hitchcock, Secy. Dept. Interior, Washington, for fixing in place steel stacks, shelves, etc., in the library of the Geological Survey.

Bids will be received May 2 by Brig.-Gen. A. W. Greely, Ch. Signal Officer, War Dept., for furnishing the signal corps 10 miles No. 12 hard-drawn copper wire, and 10 miles No. 14 galvanized iron wire.

Washington Barracks, D. C.—Bids will be received by Capt. John Stephen Sewell, Corps Engrs., U. S. A., on May 6 for common red brick and porous terra cotta tiles for reconstruction of Washington Barracks, as advertised in The Engineering Record.

**Washington Barracks, D. C.*—Capt. John Stephen Sewell, Corps Engrs., U. S. A., writes that the contract for furnishing a boom crane derrick with tower at the War College here (bids opened Apr. 10) has been awarded to Jas. L. Parsons, Washington, D. C., at $1,780, and rental $6 per day.

Honolulu, H. I.—See "Public Buildings."

Minidoka, Idaho.—Bids will be received at the office of the engineer, U. S. Reclamation Service at Boise, Idaho, on June 15 for the construction and completion of a pole line and telephone system about 18 miles in length, in connection with the Minidoka project, near Minidoka, Idaho, as advertised in The Engineering Record.

East St. Louis, Ill.—J. Stafford, of Chicago, an engineer of the Illinois Central R. R., is reported to be preparing plans for raising the embankment of the railroad 3 ft. for dyke purposes as a protection to the south side of the city from high water. The cost of the work will be shared by the city and the R. R. Co.

Chicago, Ill.—The Drainage Bd. is reported to have on Apr. 17 awarded the annual dredging and docking

**Items marked thus give the names of parties awarded contracts.*

contract to the Chicago & Great Lakes Dredging & Dock Co., at 17½ cts. per cu. yd., scow meas., for dredging, and $17.75 per lin. ft. for docking.

**Chicago, Il.*—The contract for furnishing 2,000 bbls. of Portland cement and 1,000 bbls. American cement. bids opened Apr. 19 by the South Park Comrs., has been awarded to Meacham & Wright and the Knickerbocker Ice Co.

Rock Island, Ill.—Bids will be received by Maj. C. H. Riche, Corps Engrs., U. S. A., on May 20 for the construction and repair of dams and shore protection bet. Savanna, Ill., and Le Claire, Ia., bet. Rock Island and Burlington, Ia., bet. Burlington and Hannibal, Mo., and bet. Clarksville and Cap au Gris, Mo., as advertised in The Engineering Record.

Joliet, Ill.—Bids will be received by the Comrs. of Spring Creek Drainage Dist. (Geo. H. Munroe, Chmn.) until May 4 for excavating and walling of ditches in sections.

**New Orleans, La.*—W. T. Carey & Bros., 630 Camp St., are stated to have secured from the Dock Bd. on Apr. 18 the contract for 2 wharves, one at Hospital St. and the other at Mandeville St., at $9 per M. ft. for framing and placing lumber and 6¼ cts. per lin. ft. for driving piles.

Baltimore, Md.—Bids will be received May 3 by the Bd. of Awards (E. Clay Timanus, Pres.) for furnishing material and constructing a bulkhead at Swann Park; specifications may be had at the office of the Bd. of Park Comrs., Druid Hill Park, W. W. Crosby, Gen. Supt.

**Boston, Mass.*—The following are the bids opened Apr. 17 by the Metropolitan Park Comn. (John R. Rablin, Engr.) for grading, surfacing and other work at Lynn Shore reservation, Prescott Pl. to Humphrey St., Lynn and Swampscott: Frank Williams & Co., Boston, $43,447; Fredk D. Mayo, Lynn, $30,426; Daniel E. Lynch, Dorchester, $23,655; Falvey & Kelley, Dorchester, $22,807; David J. Sheehan & Co., Lynn, $22,672; M. McDonough, Swampscott, $21,865; Coleman Bros., Everett, $21,208; H. Gore Co., Boston, $20,120, and Jas. Doherty, Boston, $19,571 (awarded contract). The detailed bid of the successful bidder, Jas. Doherty, is as follows: 3,640 cu. yds. earth grading, 21 cts.; 100 cu. yds. filling, 50 cts.; 500 lin. ft. 10-in. vit. pipe, 32 cts.; 150 lin. ft. 12-in. vit. pipe, 40 cts.; 20 concrete catch basins, $24; 1,000 sq. yds. concrete gutters, $1.20; 405 lin. ft. artificial stone steps, $1.25; 375 lin. ft. straight edgestone, 90 cts.; 340 lin. ft. curved edgestone, $1.40; 2,130 cu. yds. loam surfacing, 25 cts.; 2,880 cu. yds. loam, $1.07; 13,800 sq. yds. broken stone surfacing, 39½ cts.; 3,600 sq. yds. walk surfacing, 18 cts.; 5,200 sq. yds. granolithic walk, $1.12.

Buzzards Bay, Mass.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, R. I., on May 23 for removing Weepecket Rock, Buzzards Bay, as advertised in The Engineering Record.

Ft. Revere, Mass.—Col. W. S. Stanton, Corps Engrs., U. S. A., Boston, writes that the following are the bids opened on Apr. 14 for furnishing Portland cement at Ft. Revere: (*a*) per bbl., (*b*) in sacks: Atlantic Cement Co., Washington, D. C., *a* $1.59, *b* $1.23; Alpha Portland Cement Co., Boston, *a* $1.57, *b* $1.26; Berry & Ferguson, Boston, *a* $1.55, *b* $1.245; Waldo Bros., Boston, *a* $1.55, *b* $1.25.

Grand Rapids, Mich.—The following are the bids opened on Apr. 22 by Col. M. B. Adams, Corps Engrs., U. S. A., for dredging harbors on east shore of Lake Michigan: (*a*) group No. 1; (*b*) group No. 2 (amount available for the work, $31,300); price given per cu. yd.: Chicago & Great Lakes Dredge & Dock Co., Chicago, Ill., *a* 17¼ cts, *b* 17¼ cts.; Greiling Bros., Green Bay, Wis., *a* 19 cts., *b* 18 cts.; Samuel O. Dixon, Milwaukee, Wis., *a* 19½ cts, *b* 17½ cts.; Bennett & Schnorbach, Muskegon, *b* 18¼ cts.; The FitzSimons & Connell Co., Chicago, Ill., *a* 20 cts., *b* 20 cts.

Hoboken, N. J.—Bids will be received May 10 by the Mayor and Council, for $10,000 park bonds; Jas. H. Londrigan, City Clk.

**Atlantic City, N. J.*—The following are reported to be the bids opened on Apr. 17 by City Council for widening the Boardwalk by 10 ft. bet. Maryland and Illinois Aves.: C. W. Snyder & Co., Atlantic City, $45,417 (awarded contract); N. J. Bridge Co., Manasquan, $46,285; Groton Bridge Co., Groton, N. Y., $47,663, and Berlin Constr. Co., N. Y. City, N. Y., $48,699.

New York, N. Y.—The following are the bids opened on Apr. 27 by the Dept. Docks and Ferries for (*a*) removing present pier and building new pier to be known as Pier No. 14 Maiden Lane and Pine; (*b*) building new pier at E. 9th St.: W. H. Jenks, *a* $56,957, *b* $30,900; John Monks & Son, *a* $57,489; R. P. & J. H. Staats, *a* $54,805; Wm. J. Lawler, *a* $56,720; Snare & Triest Co., *a* $54,826; Bernard Rolf, *a* $53,396, *b* $30,333; Augustus Walsh, 96 Water St., *a* $53,180 (awarded contract), *b* $28,000 (awarded contract); G. B. Spearin, *a* $59,620, *b* $32,787.

*The following are the bids opened on Apr. 18 by the Dept. Docks and Ferries for furnishing material and dredging about 100,000 cu. yds. on East and Harlem Rivers (price given per cu. yd.): R. G. Packard, 130 Pearl St., 24.3 cts. (awarded contract); Aug. Walsh, 26 cts., and W. H. Beard Dredging Co., 32 cts.

Bids will be received until May 9 by Francis J. Lantry, Comr. of Correction, for furnishing and delivering paints, iron steam fittings, etc.

Bids will be received May 5 by Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing and delivering miscellaneous supplies, including iron, steel, engines, concrete mixers, pipes, fittings, valves, machinist's supplies, etc.

New York, N. Y.—Bids will be received May 5 by the Dept. Docks and Ferries (Maurice Featherson, Comr.) for furnishing materials required for preparing for and building a new pier at foot of Beekman St., East River, to be known as pier No. 18; also for building 3 pile drivers, 4 boat landing stages, 4 diving scows and 1 derrick.

Brooklyn, N. Y.—Bids will be received by the Park Bd., New York City (John J. Pallas, Pres.) until May 11, for furnishing delivery and putting in bulkhead at ft. of Ocean Parkway 1,200 cu. yds. boat stone; also for repairs and alterations to boundary wall around Ft. Greene Park, Boro. Brooklyn.

Albany, N. Y.—Winslow M. Mead, Deputy Supt. State Bd. Pub. Wks., writes that on Apr. 24, contract No. 6 of the barge canal work was awarded to F. A. Maselli & Co., of 1101 Farmers' Bank Bldg., Pittsburg, Pa.

Albany, N. Y.—Barge canal bonds to the amount of $2,000,000 were sold on Apr. 20.

Pittsburg, Pa.—The following are the bids opened on Apr. 17 and 18 by Maj. Wm. L. Siebert, Corps Engrs., U. S. A., Pittsburg, for work in connection with the construction of dams: (*a*) Dravo Contr. Co., Pittsburg; (*b*) Baker Contract. Co., Pittsburg; (*c*) Jas. H. McQuade, Pittsburg; (*d*) Ohio River Contract. Co., Evansville, Ind.

Dam No. 2.—Six Mile Island, Allegheny River.

	a	*b*	*c*
27,700 cu. yds. gravel excav.	$1.00	$0.75	$0.60
2,833 cu. yds. back fill	.50	.75	.60
6,140 cu. yds. emb'km't	.50	.75	.60
25,550 lin. ft. round piles	.50	.50	.45
229.5 M. ft. sheet piles	90.00	80.00	70.00
301.754 M. ft. oak timber	†60.00	80.00	70.00
342.78 M. ft. hemlock timber	45.00	60.00	50.00
9,235 cu. yds. stone crib fill.	3.50	3.00	2.50
5,383 cu. yds. large stone	3.50	3.00	2.50
9,852 cu. yds. concrete	6.00	8.00	7.00
80,000 lbs. drift bolts	.05	.06	.05
Total	$213,422	$230,817	$197,337

†If any kind of hardwood, $55.

Building 100 ft. of Chanoine dam, 2 bear-trap dam foundations, ea. 93 ft. long, a Chanoine weir 160 ft. long, 3 piers and abutment, Dam No. 3, Ohio River, at Glenosborne, Pa.

	a	*b*	*d*
25,000 cu. yds. excav.	$1.00	$0.90	$0.80
186 M. ft. hemlock timber	55.00	60.00	50.00
67 M. ft. oak timber	90.00	90.00	80.00
450,000 lbs. wrought iron and steel	.08	.07	.06
143,955 lbs. cast iron	.06	.06	.06
200 lbs. bronze	1.00	.50	.50
630 lin. ft. galvanized iron pipe, 4-in. dia.	1.00	1.00	1.00
1,114 lin. ft. galvanized iron pipe, 3-in. dia.	.75	.75	.90
310 lin. ft. black pipe, 2-in. dia.	.30	.50	.50
23,400 lin. ft. round piling	.50	.65	.65
212 M. ft. sheet piling	95.00	90.00	90.00
9,550 cu. yds. concrete	8.00	8.50	8.50
4,000 cu. yds. stone crib fill.	3.00	3.00	3.00
1,770 cu. yds. large stone	4.00	3.50	3.00
6,000 cu. yds. common fill.	.60	.70	.75
180 sq. yds. paving—vitr. brick	2.50	4.00	3.00
300 cu. yds. riprap stone bank-covering	3.00	7.00	6.00
87 M. ft. crib decking	60.00	60.00	60.00
Total	$225,146	$227,448	$217,020

Building 303 ft. of Chanoine Dam, 2 bear-trap dam foundations, ea. 93 ft. long, a Chanoine weir 96 ft. long, 3 piers and abutment, Dam No. 5, Ohio River, near Freedom, Pa.

	d	*b*	*a*
30,000 cu. yds. excav.	$0.80	$0.80	$0.70
240 M. ft. hemlock timber	50.00	60.00	50.00
90 M. ft. oak timber	80.00	90.00	90.00
116.6 M. ft. crib decking timber	60.00	65.00	55.00
200,000 lbs. cast iron	.06	.06	.05
600,000 lbs. wrought iron and steel	.06	.07	.07
200 lbs. bronze	.50	.50	.40
10,600 cu. yds. concrete	8.50	8.00	7.50
7,600 tons stone fill. (crib)	†3.00	2.00	2.25
5,000 tons riprap stone	†3.00	2.30	2.25
6,000 cu. yds. common fill.	.75	.70	.50
1,400 lin. ft. 3-in. galvanized iron pipe	1.00	.75	1.00
1,300 lin. ft. 4-in. galvanized iron pipe	.90	1.00	1.25
250 lin. ft. 2-in. black iron pipe	.50	.50	.40
360 sq. yds. brick paving	3.00	3.00	1.50
340 M. ft. sheet piling	90.00	90.00	95.00
45,000 lin. ft. piling (round or bearing)	.65	.65	.60
Total	$296,321	$287,284	$273,408

†Per cu. yd.

Watervliet, N. Y.—Bids will be received May 15 by Maj. Ira MacNutt, Comdg., for furnishing ordnance supplies for Watervliet Arsenal during year ending June 30, 1906, including iron and steel.

Buffalo, N. Y.—Bids will be received by Lieut.-Col. H. M. Adams, Corps. Engrs., U. S. A., May 26, for dredging in Buffalo River entrance channel, as advertised in The Engineering Record.

Cleveland, O.—Bids will be received May 22 by Lieut-Col. Dan C. Kingman, Corps Engrs., U. S. A., 262 Huron St., for dredging Cleveland Harbor.

Panama.—Bids will be received by the Isthmian Canal Comn., Washington, D. C., May 16 for furnishing one 10-ton and one 20-ton locomotive cranes, as advertised in The Engineering Record.

Bids will be received by the Isthmian Canal Comn., Washington, D. C., May 24, for furnishing pipe, pipe fittings, pig lead, tools, etc., as advertised in The Engineering Record.

Allentown, Pa.—See "Sewerage and Sewage Disposal."

Erie, Pa.—Bids will be received on May 22 by Lieut. Col. H. M. Adams, Corps Engrs., U. S. A., Buffalo, N. Y., for extending south pier and placing concrete superstructure on north pier at Erie, as advertised in The Engineering Record.

Pittsburg, Pa.—Bids will be received May 19 by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., for building and erecting in place 2 pairs of steel lock gates and anchorages at lock No. 2, Allegheny River; also on May 20 for building and delivering at new lock No. 2 Monongahela River, Pa., a steel movable top for dam No. 2, Monongahela River.

Bids will be received by Maj. Wm. L. Sibert, Corps Engrs., U. S. A., Pittsburg, May 27, for building a lock with two chambers, two guide walls and a guard wall near Elizabeth, Pa., as advertised in The Engineering Record.

Philadelphia, Pa.—Local press reports state that the Philadelphia Rapid Transit Co. (W. S. Twining, Ch. Engr., 820 Dauphin St.) will shortly award contract for a $100,000 wharf, to be erected at Pier 34, north, below Fairmount Ave. It will have a frontage of 120 ft. on Delaware Ave., extending into the Delaware River 450 ft.

Block Island, R .I.—Bids will be received by Lieut. Col. J. H. Willard, Corps Engrs., U. S. A., Newport, on May 23 for repairing breakwater; also on same for dredging at harbor of refuge, Block Island, both advertised in The Engineering Record.

Columbia, S. C.—Bids will be received until May 12 by the Comn. for the completion of the State House for metal filing equipment for 3 offices in the State House. Chas. C. Wilson, Archt., Columbia.

Nashville, Tenn.—Bids will be received by Maj. H. C. Newcomer, Corps Engr., U. S. A., on May 29, for 2 steel lock gates and filling valves, etc., at Lock No. 2, Cumberland River, as advertised in The Engineering Record.

Memphis, Tenn.—Bids will be received by Capt. E. W. Van C. Lucas, Corps Engrs., U. S. A., May 25 for about 1,800,000 cu. yds. levee work in the 1st and 2d Dists., Mississippi River Improv., as advertised in The Engineering Record.

Wheeling, W. V.—Bids will be received May 10 by the Bd. Co. Comrs. for constructing and repairing a stone and concrete retaining wall along the National Road near this city; estimated cost, 15,000. Herman L. Arbenz, Co. Engrs.

**Superior, Wis.*—The Lake Superior Contr. & Dredging Co., of Superior, is stated to have secured the contract for dredging 49,000 cu. yds. of sand, gravel and riprap for trench for easterly half of the new South pier at the Superior entry, for about $13,000.

Valparaiso, Chili.—On Apr. 2, 1906, bids will be opened in Santiago, Chili, for the construction of docks and the improvement of the harbor of Valparaiso, as advertised in The Engineering Record. Plans and specifications may be seen at the office of Chilean Legation, 1228 17th St., Washington, D. C., and at the office of the Consulate-General, 135 W. 11th St., N. Y. City. The cost of the work amounts to about $12,500,000.

**Winnipeg, Man.*—C. J. Brown, City Clk., writes that the contract for furnishing the city with 20,000 to 30,000 bbls. cement (Samson) has been awarded to the Owen Sound Portland Cement Co., of Owen Sound, at 68.42 cts. per 100 lbs. net (bids opened Apr. 4).

PROPOSALS OPEN

For Proposals see pages 52, 53, 56, 57, 58, 59.

WATER WORKS.

Bids Close.		See Eng. Record.
May 2.	Improv. Water Wks., Elyria, O.	Apr. 29
May 2.	Flow line, St. Louis, Mo.	Apr. 15
May 2.	Pipe laying, Cincinnati, O.	Apr. 8
May 2.	Washington, D. C.	Apr. 22
May 2.	Boilers, etc., Norwalk, O.	Apr. 22
May 2.	Plans for system, Melrose, Minn.	Apr. 29
May 3.	Lexington, N. C. Adv. Apr. 15, 22.	Apr. 15
May 3.	Humboldt, Kan. Adv. Apr. 22	Apr. 22
May 3.	Hydrants, etc., N. Y., N. Y.	Apr. 22
May 4.	Imp. plant, De Pere, Wis.	Apr. 15
May 4.	Pump. plant, San Diego, Cal.	Apr. 29
May 5.	Pipe, etc., West Point, N. Y. Adv. Apr. 8 to 29.	Apr. 8
May 6.	Tank, Ft. Reno, Okla. Ter.	Apr. 15
May 10.	Chamberlain, S. D.	Apr. 22
May 10.	Pipe, Dayton, O.	Apr. 29
May 10.	Meters, Dayton, O.	Apr. 29
May 10.	Reservoir improv., Boston, Mass. **Adv. Apr. 29.**	Apr. 29
May 11.	Pipe, New Orleans, La.	Mar. 25
May 11.	Pipe, West Point, N. Y. Adv. Apr. 15 to 29	Apr. 15
May 11.	System, Ft. Ontario, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 12.	Pipe, etc., Cincinnati, O.	Apr. 22
May 14.	System, Mansfield, La. Adv. Mar. 4, 11.	Mar. 4
May 15.	Engine, etc., Montreal, Que Adv. Mar. 11.	Mar. 11
May 15.	Gates, etc., La Junta, Colo	Apr. 29
May 16.	Irrig. work, North Platte, Neb. Adv. Mar. 25 to Apr. 29.	Mar. 25
May 18.	Pipe, valves, etc., Ft. Assinniboine, Mont.	Apr. 29

**Items marked thus give the names of parties awarded contracts.*

May 20.	Curb, intake, etc., Oswego, N. Y. Adv. Apr. 29.	Apr. 29
Jun. 1.	Canal, etc., Glendive, Mont. Adv. Apr. 8 to 29.	Apr. 8
Jun. 15.	Canal, etc., Minidoka, Idaho Adv. Apr. 22, 29.	Apr. 22
Jun. —.	Prescott, Wash.	Apr. 1
Jun. —.	Alma, Wash.	Apr. 22
Jun. —.	Pumps, etc., Richland, Ga.	Apr. 22
Jun. —.	Pipe, etc., Thibodaux, La.	Apr. 22
———	Granbury, Tex.	Apr. 29

SEWERAGE AND SEWAGE DISPOSAL.

May 2.	Waterbury, Conn.	Apr. 15
May 2.	St. Louis, Mo.	Apr. 22
May 2.	South Bend, Ind.	Apr. 29
May 2.	Allentown, Pa.	Apr. 29
May 3.	Cincinnati, O.	Apr. 15
May 3.	Brooklyn, N. Y.	Apr. 22
May 3.	Elkhart, Ind.	Apr. 29
May 4.	Saltsburg, Pa.	Apr. 15
May 4.	Jacksonville, Fla.	Apr. 29
May 4.	McKeesport, Pa.	Apr. 29
May 4.	Harrisburg, Pa.	Apr. 29
May 5.	Spartanburg, S. C.	Apr. 29
May 6.	Ft. Wayne, Ind.	Apr. 15
May 6.	Longmeadow, Mass.	Apr. 29
May 8.	Berea, O.	Apr. 22
May 8.	Akron, O.	Apr. 29
May 8.	Cincinnati, O.	Apr. 29
May 9.	Wellsville, N. Y. Adv. Apr. 22.	Apr. 22
May 9.	Tipton, Ind.	Apr. 29
May 9.	Fremont, O.	Apr. 29
May 9.	Youngstown, O.	Apr. 29
May 10.	Chamberlain, S. D.	Apr. 22
May 12.	Idaho Falls, Idaho. Adv. Apr. 22, 29.	Apr. 22
May 12.	Lestershire, N. Y. Adv. Apr. 29.	Apr. 29
May 14.	Birmingham, Ala.	Apr. 22
May 15.	Kenosha, Wis.	Apr. 29
May 17.	Washington, D. C. Adv. Apr. 22, 29.	Apr. 22
May 18.	Mt. Carmel, Pa. Adv. Apr. 29.	Apr. 29
May 19.	Steubenville, O.	Apr. 29
May —.	New Britain, Conn.	Apr. 8

BRIDGES.

May 2.	Carrollton, Mo.	Apr. 15
May 2.	Norwalk, O.	Apr. 22
May 2.	Plymouth, Ind.	Apr. 22
May 2.	Albion, Ind.	Apr. 29
May 2.	Trenton, N. J.	Apr. 29
May 3.	Peru, Ind.	Apr. 8
May 3.	Wabash, Ind.	Apr. 8
May 3.	Bluffton, Ind.	Apr. 15
May 3.	Vincennes, Ind.	Apr. 29
May 4.	Wabash, Ind.	Apr. 15
May 4.	Columbus, O.	Apr. 15
May 4.	Birmingham, Ala.	Apr. 15
May 4.	Bryan, O.	Apr. 22
May 4.	Jersey City, N. J.	Apr. 22
May 5.	Lockland, O.	Apr. 8
May 5.	Floodwood, N. J.	Apr. 29
May 5.	Martinsville, Ind.	Apr. 29
May 8.	Olivet, S. D.	Apr. 22
May 8.	Stillwater, Okla. Ter.	Apr. 29
May 10.	Pembina, N. D.	Apr. 22
May 10.	Cleveland, O.	Apr. 22
May 10.	Lisbon, N. D.	Apr. 29
May 11.	New York, N. Y.	Apr. 22
May 16.	Kingstree, S. C.	Apr. 29
May 17.	Cleveland, O.	Apr. 22
May 17.	Pittsburg, Pa.	Apr. 29
May 24.	Ellendale, N. D.	Apr. 29

PAVING AND ROADMAKING.

May 2.	Trenton, N. J., Adv. Apr. 15 to 29	Apr. 15
May 2.	Bloomfield, Ind.	Apr. 15
May 2.	Versailles, Ind.	Apr. 15
May 2.	St. Paul, Minn.	Apr. 22
May 2.	Newark, N. J.	Apr. 29
May 2.	Cumberland, Md.	Apr. 29
May 2.	Delawanna, N. J.	Apr. 29
May 2.	South Bend, Ind.	Apr. 29
May 2.	Lexington, Ky.	Apr. 29
May 2.	Laurium, Mich.	Apr. 29
May 2.	Allentown, Pa.	Apr. 29
May 2.	Hagerstown, Md.	Apr. 29
May 3.	Brooklyn, N. Y.	Apr. 22
May 3.	Baltimore, Md.	Apr. 29
May 4.	Cincinnati, O.	Apr. 15
May 4.	St. Charles, Mo. Adv. Apr. 15, 22.	Apr. 1
May 4.	Akron, O.	Apr. 22
May 4.	New York, N. Y.	Apr. 29
May 5.	Holyoke, Mass. (3 prop.) Adv. Apr. 22, 29.	Apr. 22
May 5.	Akron, O.	Apr. 29
May 6.	Washington, Pa.	Apr. 15
May 6.	Cleveland, O.	Apr. 22
May 8.	Delaware, O.	Apr. 22
May 8.	National Home, Wis.	Apr. 22
May 8.	Edgewood, Pa.	Apr. 29
May 9.	Delaware, O.	Apr. 22
May 9.	Atlantic City, N. J.	Apr. 15
May 9.	Peru, Ind.	Apr. 22
May 9.	Wellsville, N. Y. Adv. Apr. 22, 29	Apr. 22
May 9.	St. Louis, Mo	Apr. 29
May 9.	Brazil, Ind.	Apr. 29
May 10.	Ft. Greble, R. I. Adv. Apr. 15 to 29.	Apr. 15
May 10.	Cincinnati, O.	Apr. 22
May 10.	Delaware, O.	Apr. 22
May 10.	Elmira, N. Y.	Apr. 29
May 10.	Pine Bluff, Ark.	Apr. 29
May 10.	Freehold, N. J., Adv. Apr. 29	Apr. 29
May 11.	New York, N. Y.	Apr. 22
May 11.	York, Pa.	Apr. 29
May 12.	Washington, D. C. (2 prop.) Adv. Apr. 29.	Apr. 29
May 13.	Cleveland, O.	Apr. 22
May 13.*	Norwood, O.	Apr. 22
May 13.	Washington, D. C. Adv. Apr. 29.	Apr. 29
May 15.	Henderson, N. C. Adv. Apr. 29.	Apr. 29
May 15.	Celina, O.	Apr. 29
May 20.	**Ft. Mackenzie, Wyo** Adv. Apr. 29.	Apr. 29
May 22.	**Bluefield, W. Va** Adv. Apr. 29.	Apr. 29
May 22.	Wyoming, O.	Apr. 29
May 27.	**Ft. Ontario, N. Y.** Adv. Apr. 29.	Apr. 29

Jun. 1.	Owensboro, Ky.	Apr. 22
———	Grenada, Miss.	Apr. 29

POWER, GAS AND ELECTRICITY.

May 2.	Ft. Ontario, N. Y. Adv. Apr. 8 to 29.	Apr. 8
May 2.	Lafayette, Ind.	Apr. 22
May 2.	Washington, D. C.	Apr. 22
May 2.	Athens, Ga.	Apr. 29
May 2.	Norfolk, Va.	Apr. 29
May 2.	Washington, D. C.	Apr. 29
May 2.	Melrose, Minn.	Apr. 29
May 3.	Washington, D. C.	Apr. 8
May 3.	Ft. Brady, Mich., Adv. Apr. 15 to 29.	Apr. 15
May 3.	Washington, D. C.	Apr. 29
May 3.	Anniston Ala.	Apr. 29
May 5.	New York, N. Y.	Apr. 29
May 8.	Binghamton, N. Y.	Apr. 22
May 8.	Richmond, Va. Adv. Apr. 29.	Apr. 29
May 8.	Bisbee, Ariz.	Apr. 29
May 9.	Fulton, Mo.	Apr. 29
May 10.	Lyons, Kan.	Apr. 8
May 10.	Ft. Sheridan, Ill.	Apr. 29
May 10.	Red Bluff, Cal.	Apr. 29
May 10.	Franchise, Bristol, Va.	Apr. 29
May 12.	Pittsburg, Pa.	Apr. 22
May 15.	Jewell City, Kan.	Mar. 18
May 15.	Louisville, Ky.	Apr. 29
May 23.	Washington, D. C.	Apr. 29
May 31.	Washington, D. C. Adv. Apr. 29.	Apr. 29
May —.	Meridian, Miss.	Mar. 25
Jun. 1.	Spartanburg, S. C.	Apr. 29
Jun 3.	Cape Charles, Va.	Apr. 8
Jun. 6.	Sebastapol, Cal.	Apr. 22
Jun. 8.	Newport, Ky.	Apr. 29

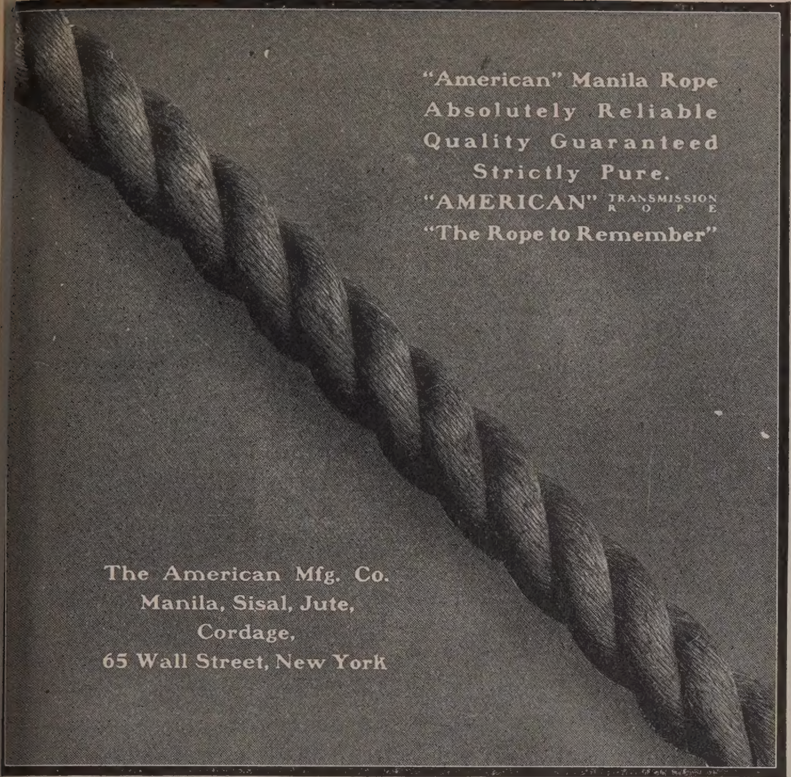
BUILDINGS.

May 2.	Hospital, St. Louis, Mo.	Apr. 8
May 2.	Court House, Detroit, Mich.	Apr. 15
May 2.	School, Madison, Wis.	Apr. 15
May 2.	Bus. Bldg., New Bedford, Mass.	Apr. 22
May 2.	Pub. Bldg., Janestown, N. D.	Apr. 22
May 2.	Library, Rockhill, S. C.	Apr. 22
May 2.	Hospital, Buffalo, N. Y.	Apr. 29
May 2.	Pub. Bldg., Chicago, Ill.	Apr. 29
May 2.	Pub. Bldg., Little Rock, Ark	Apr. 29
May 2.	Church, Janesville, Wis.	Apr. 29
May 3.	Court House, Vinton, Ia.	Apr. 1
May 3.	Court House, Hillsboro, N. D.	Apr. 22
May 3.	Pub. Bldg., Wash., D. C.	Apr. 22
May 3.	School, Buffalo, N. Y.	Apr. 29
May 4.	Boat House, Ft. Morgan, Ala. Adv. Apr. 15 to 29.	Apr. 15
May 4.	School, Steubenville, O.	Apr. 22
May 4.	School, Fairfield, Ia.	Apr. 22
May 4.	School, Pittsburg, Pa.	Apr. 29
May 4.	Y. M. C. A. Bldg., Waco, Tex.	Apr. 29
May 5.	School, Cleveland Hgts., O.	Apr. 22
May 5.	Church, Manning, S. C.	Apr. 29
May 5.	Church, Lewisville, Tex.	Apr. 29
May 5.	School, Duncan, Ind.	Apr. 29
May 5.	College, Anniston, Ala.	Apr. 29
May 6.	P. O. Bldg., Florence, S. C.	Apr. 8
May 6.	Infirmary, Valparaiso, Ind.	Apr. 22
May 6.	Pub. Bldgs., Twin Bridges, Mont.	Apr. 29
May 6.	Library, Franklin, N. H.	Apr. 29
May 8.	Interior finish, U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18.	Mar. 18
May 8.	School, Albuquerque, N. M.	Apr. 22
May 8.	Hospital, Farmington, Mo.	Apr. 29
May 8.	Court House, Lebanon, Va.	Apr. 29
May 8.	School, New York, N. Y.	Apr. 29
May 8.	School, Brooklyn, N. Y.	Apr. 29
May 8.	School, Jamaica, L. I., N. Y.	Apr. 29
May 8.	Engine house, Indianapolis, Ind.	Apr. 29
May 8.	School, Trafford City, Pa.	Apr. 29
May 9.	Mech. Equip. U. S. Custom House, New York, N. Y., Adv. Mar. 11, 18.	Mar. 18
May 9.	School, Phoenix, Ariz.	Apr 22
May 9.	Pub. Bldgs., Concord, N. H.	Apr. 22
May 9.	Infirmary, etc., Steubenville, O.	Apr. 22
May 9.	Htg. Hospital, Fulton, Mo.	Apr. 29
May 10.	Pub. Bldg., Norwalk, O.	Apr. 22
May 10.	School, Chamberlain, S. D.	Apr. 22
May 10.	Court House, Grundy, Va.	Apr. 22
May 10.	**Light House, Portland, Ore.**	Apr. 29
May 10.	Engine house, Pittsburg, Pa.	Apr. 29
May 11.	P. O. Bldg., Laramie, Wyo.	Apr. 8
May 11.	Hospital Improv., Ft. Assinniboine, Mont.	Apr. 15
May 11.	School, Zuni, N. M.	Apr. 22
May 11.	School, Salem, N. J.	Apr. 22
May 11.	School plans, Sacramento, Cal.	Apr. 22
May 11.	Hospital, Cincinnati, O.	Apr. 22
May 11.	**Shelters, Brooklyn, N. Y.**	Apr. 29
May 11.	Hospital, Ft. Assinniboine, Mont.	Apr. 29
May 12.	Arsenal, Philadelphia, Pa.	Apr. 22
May 13.	School, Des Moines, Ia.	Apr. 22
May 13.	Terra-cotta for War College, Washington Barracks, D. C., Adv. Apr. 15 to 29.	Apr. 15
May 15.	School, Port Arthur, Tex.	Apr. 1
May 15.	Post Bldgs., Ft. Sam Houston, Tex. Adv. Apr. 15, 22.	Apr. 15
May 15.	Univ., Wilberforce, O.	Apr. 22
May 15.	Hospital pav., Swinburne Island, N. Y. Adv. Apr. 29.	Apr. 29
May 16.	Pub. Bldg., Elkhart, Ind.	Apr. 15
May 17.	Pub. Bldg., Wash., D. C.	Apr. 22
May 17.	Hospital, Dayton, O.	Apr. 22
May 18.	Pub. Bldg., National Home, Wis.	Apr. 22
May 20.	School, Brooklyn, O.	Apr. 29
May 22.	Post Bldgs., Prescott, Ariz. Adv. Apr. 15 to 29.	Apr. 15
May 22.	P. O. Bldg., Oil City, Pa. Adv. Apr. 15, 22.	Apr. 15
May 22.	Post Bldgs., Wash. Barracks, D. C. Adv. Apr. 29.	Apr. 29
May 23.	P. O. Bldg., Owosso, Mich.	Apr. 22
May 23.	Hospital, Raleigh, N. C.	Apr. 29
May 24.	P. O. Bldg., Pekin, Ill.	Apr. 29
May 25.	P. O. Bldg., Geneva, N. Y. Adv. Apr. 22, 29.	Apr. 22
May 25.	Post Bldg., Ft. du Pont, Del. Adv. Apr. 29.	Apr. 29
May 25.	Post Hosp., Ft. Riley, Kan. Adv. Apr. 29.	Apr. 29
May 31.	P. O. Bldg., Allentown, Pa.	Apr. 29
Jun. 1.	P. O. Bldg., Little Falls, N. Y. Adv. Apr. 29.	Apr. 29
Jun. 5.	Capitol, Frankfort, Ky.	Apr. 22
Jun. 5.	P. O. Bldg., Crawfordsville, Ind.	Apr. 29
Jun. 6.	P. O. Bldg., Rockhill, S. C.	Apr. 29
Jun. 12.	Capitol plans, Boise, Idaho	Apr. 22
Jun. 15.	Court House plans, New Orleans, La.	Feb. 25
Jun. 15.	Synagague plans, Houston, Tex.	Apr. 15
Jun. 15.	Court House plans, New Orleans, La.	Apr. 22
Jun. 15.	Pub. bldg., Honolulu, H. I.	Apr. 29
Jun. 20.	School, Dillon, Mont.	Apr. 15
———	School plans, Needham, Mass.	Apr. 22
———	Jail, etc., Beaufort, N. C.	Apr. 15
———	Bus. Bldg., Mineral Wells, Tex.	Apr. 29
———	Factory, Corinth, Miss.	Apr. 29
Aug. 1.	Y. M. C. A. Bldg., Spokane, Wash.	Apr. 29

MISCELLANEOUS.

May 2.	Tools, etc., Panama Adv. Apr. 1 to 29.	Apr. 1
May 2.	Drainage work, Breckenridge, Minn.	Apr. 15
May 2.	Supplies, Washington, D. C.	Apr. 22
May 2.	Pier, Edgewater, N. J. Adv. Apr. 22, 29.	Apr. 22
May 2.	Wire, Washington, D. C.	Apr. 29
May 2.	Street cleaning, Allentown, Pa.	Apr. 29
May 3.	Steam shovels, Panama Adv. Apr. 1 to 29.	Apr. 1
May 3.	Dredging, Newport, R. I. Adv. Apr. 1 to 22.	Apr. 1
May 3.	Dam, Parkersburg, W. Va. Adv. Apr. 8 to 29.	Apr. 8
May 3.	Jetty construction, Nantucket, Mass. Adv. Apr. 8 to 29.	Apr. 8
May 3.	Bulkhead, Baltimore, Md.	Apr. 29
May 3.	Steel stacks, etc., Wash., D. C.	Apr. 29
May 4.	Garb. Disp., Philadelphia, Pa.	Apr. 8
May 4.	Screenings, etc., Brooklyn, N. Y.	Apr. 22
May 4.	Ditch, Joliet, Ill.	Apr. 29
May 5.	R. R. supplies, Panama	Apr. 22
May 5.	**Pier, etc., New York, N. Y.**	Apr. 29
May 5.	**Supplies, New York, N. Y.**	Apr. 29
May 6.	Quay Wall, Bremerton, Wash.	Mar. 18
May 6.	Breakwater work, Cleveland, O.	Apr. 8
May 6.	Cableways, Guantanamo, Cuba	Apr. 15
May 6.	Brick, etc., Wash. Barracks, D. C. Adv. Apr. 29.	Apr. 29
May 8.	Dredging, Newport, R. I. Adv. Apr. 15 to 29.	Apr. 15
May 9.	Supplies, Washington, D. C.,	Apr. 22
May 9.	Iron, etc., New York, N. Y.	Apr. 29
May 10.	Ditch, Stevens Point, Wis.	Feb. 25
May 10.	Elevator, New York, N. Y.	Apr. 8
May 10.	Earth spreaders, etc., Panama Adv. Apr. 15 to 29.	Apr. 15
May 10.	Supplies, Washington, D. C.	Apr. 22
May 10.	Cable, Charlevoix, Mich.	Apr. 22
May 10.	Dredging, Newport, R. I. Adv. Apr. 22, 29.	Apr. 22
May 10.	Retaining wall, Wheeling, W. Va.	Apr. 29
May 11.	Paints, garbage carts, etc., Panama Adv. Apr. 22, 29.	Apr. 22
May 11.	Stone, Port Harford, Cal.	Apr. 22
May 11.	Drain, Auburn, Ind. Adv. Apr. 22, 29.	Apr. 22
May 11.	**Stone, etc., Brooklyn, N. Y.**	Apr. 29
May 12.	Removing rock, New York, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 12.	Supplies, Panama (2 prop.) Adv. Apr. 15 to 29.	Apr. 15
May 12.	Drain, Pittsburg, Pa.	Apr. 22
May 12.	Filing equip., Columbia, S. C.	Apr. 29
May 13.	Supplies, Panama (2 prop.) Adv. Apr. 15 to 29.	Apr. 15
May 13.	Pier improv., Buffalo, N. Y. Adv. Apr. 15 to 29.	Apr. 15
May 13.	Rip rap, Ashland, Wis. Adv. Apr. 22, 29.	Apr. 22
May 15.	Dredging, Providence, R. I. Adv. Apr. 15 to 29.	Apr. 15
May 15.	Sanitary fixtures, etc., Panama (2 prop.) Adv. Apr. 15 to 29.	Apr. 15
May 15.	Excav., Chicago, Ill., Adv. Apr. 22, 29	Apr. 22
May 15.	Channel excav., Erie, Pa. Adv. Apr. 22, 29.	Apr. 22
May 15.	Supplies, Watervliet, N. Y.	Apr. 29
May 16.	Supplies, Washington, D. C.	Apr. 15
May 16.	Dredging, etc., Milwaukee, Wis. Adv. Apr. 22, 29.	Apr. 22
May 16.	Cement. Wheeling, W. Va. Adv. Apr. 22, 29.	Apr. 22
May 16.	Pine, etc. Panama. Adv. Apr. 15 to 29	Apr. 15
May 16.	Transit tunnel, Boston, Mass. Adv. Apr. 29.	Apr. 29
May 16.	Cranes, Panama Adv. Apr. 29.	Apr. 29
May 17.	Fire escapes, Wash., D. C.	Apr. 22
May 17.	R. R. tools, etc., Panama Adv. Apr. 22, 29.	Apr. 22
May 18.	Brick, screens, etc. Panama Adv. Apr. 22, 29.	Apr. 22
May 18.	Explosives, Panama, Adv. Apr. 22, 29	Apr. 22
May 19.	Jetty work, Savannah, Ga. Adv. Apr. 22, 29.	Apr. 22
May 19.	Pine, Panama. Adv. Apr. 22, 29	Apr. 22
May 19.	Pier, Cleveland, O.	Apr. 22
May 19.	Lock gates, etc., Pittsburg, Pa.	Apr. 29
May 20.	Breakwater, Buffalo, N. Y. Adv. Apr. 22, 29.	Apr. 22
May 20.	Dam, Rock Island, Ill. Adv. Apr. 22, 29.	Apr. 22
May 20.	Dam improv., Pittsburg, Pa.	Apr. 29
May 22.	Pier, Erie, Pa. Adv. Apr. 29.	Apr. 29
May 22.	Dredging, Cleveland, O.	Apr. 29
May 23.	Supplies, Washington, D. C.	Apr. 22
May 23.	Breakwater, Block Island, R. I. Adv. Apr. 29.	Apr. 29
May 23.	**Dredging, Block Island, R. I.** **Adv. Apr. 29.**	Apr. 29
May 23.	Remov. rock, Buzzards Bay, Mass. Adv. Apr. 29.	Apr. 29
May 23.	R. R. supplies, New Orleans, La.	Apr. 29
May 24.	Pipe, tools, etc, Panama	Apr. 29
May 25.	**Levee work, Memphis, Tenn.** Adv. Apr. 29.	Apr. 29
May 26.	**Dredging, Buffalo, N. Y.** Adv. Apr. 29.	Apr. 29
May 27.	**Lock, etc., Pittsburg, Pa.** Adv. Apr. 29.	Apr. 29
May 29.	**Lock gates, etc., Nashville, Tenn.** Adv. Apr. 29.	Apr. 29
Jun. —.	Dam, Iowa City, Ia.	Apr. 22
Jun. 15.	**Pole and telephone line, Minidoka, Idaho. Adv. Apr. 22, 29.**	Apr. 22
Jul 1.	Municipal St. Ry. system, Chicago, Ill. Adv. Apr. 15 to 29.	Apr. 15
Jun. 15.	Wharf, etc., Honolulu	Apr. 29
Sep. 1.	Steel and iron, Sydney, N. S. Wales. Adv. Apr. 8.	Apr. 22
———	R. R. work, Oglethorpe, Ga.	Apr. 22
Apr. 2, '06.	**Harbor Work, Valparaiso, Chili.** **Adv. Apr. 29.**	Apr. 29

**Items marked thus give the names of parties awarded contracts.*



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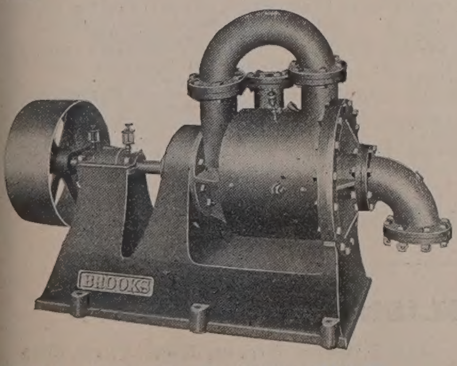

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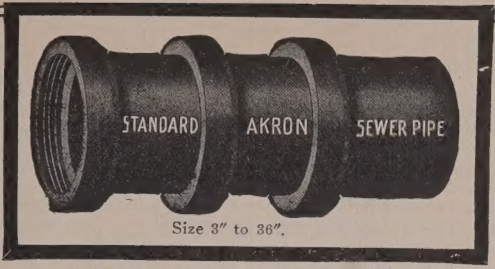

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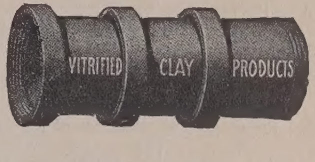

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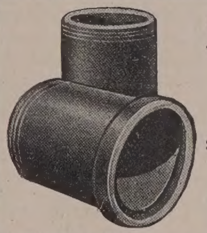

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PROPOSALS.

Sewers.

NOTICE TO CONTRACTORS.

Lestershire, N. Y.

Sealed proposals will be received by the Board of Trustees of the village of Lestershire, N. Y., until 8 o'clock P. M., on the 12th day of May, 1905, for the construction of about three miles of pipe sewers, with their manholes, lampholes and other accessories, including all material, tools and labor necessary to complete the same.

The estimated maximum cost of the construction of such sewers is the sum of $40,000, and the estimated minimum cost thereof is the sum of $24,000.

Plans and profiles may be seen and specifications obtained at the office of the clerk of the Board of Trustees in the village of Lestershire, N. Y., and plans and specifications seen at the office of Knight & Hopkins, Engineers, Rome, N. Y.

Bids will be received for the whole work only.

The Board of Trustees reserves and has the right to accept or reject any proposal, to contract with other than the lowest bidder, or to reject all bids and advertise again.

A bond satisfactory to the Board of Trustees in amount and sureties, and in a sum equal to 40 per cent. of the contract price, will be required of the bidder to whom the contract may be awarded. The sureties shall be residents of the State of New York, or a surety company organized under the laws of and doing business in the State of New York—the latter preferred. Each bidder will be required to state in his proposal the names and addresses of his bondsmen.

A certified check upon a State or National bank to the amount of $1,000, drawn to the order of the Treasurer of the village of Lestershire, N. Y., must be deposited by each bidder as a guarantee that in case the contract is awarded him he will, within seven days after notification of award, execute said contract.

Proposals must be on forms submitted by the Board of Trustees, and must be sealed and addressed or delivered to J. E. Hill, Clerk of the village of Lestershire, N. Y., and marked on the outside of the envelope enclosing them, "Proposals for Lestershire Sewers."

Dated, 1905.

J. F. CHAMBERS, President.
J. E. HILL, Village Clerk.

U. S. ENGINEER OFFICE, PITTSBURG, Pa., April 27, 1905.—Sealed proposals for building a lock with two chambers, two guide walls and a guard wall, near Elizabeth, Pa., on the Monongahela River, will be received at this office until 12 M., May 27, 1905, then publicly opened. Information furnished on application. WM. L. SIBERT, Major, Engrs.

OFFICE OF THE COMMISSIONERS, D. C., Washington, D. C., April 26, 1905.—Sealed proposals will be received until 12 o'clock M., May 31, 1905, for constructing and installing heating, lighting, power plant and water supply for Industrial Home School at Blue Plains, D. C., near Shepherd's Landing, on grounds of new Municipal Almshouse; also sewerage system to connect with or from extension of sewerage of the Almshouse. Proposals must be accompanied by complete working drawings and specifications; also certified check or receipt of the Collector of Taxes, D. C., for $1,000, to guarantee execution of contract. Award will be made on the basis of the best system, as indicated by plans and specifications, and the lowest responsible bid. Plans of buildings now under construction and proposed buildings may be seen at the office of the Inspector of Buildings. HENRY B. F. MACFARLAND, HENRY L. WEST, JOHN BIDDLE, Commissioners, D. C.

DEPARTMENT OF THE INTERIOR, Washington, D. C., April 27, 1905. United States Geological Survey, Reclamation Service. Sealed proposals will be received at the office of the Supervising Engineer, United States Reclamation Service, Chamber of Commerce Building, Denver, Colo., until 2 o'clock P. M., Thursday, June 15, 1905, and thereafter opened, for the construction of the Pathfinder dam and auxiliary works, at a point about 50 miles southwest of Casper, Wyo., to impound the flow of North Platte River. Plans, specifications and forms of proposal may be obtained by application to the Chief Engineer of the Reclamation Service, U. S. Geological Survey, Washington, D. C., or to the Supervising Engineer of the Reclamation Service, at Denver, Colo. Each bid must be accompanied by a certified check for $5,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of $50,000 for the faithful performance of the work. Each bid must also be accompanied by the guaranty of responsible sureties to furnish bond as required, if bid be accepted. The right is reserved to reject any and all bids, to accept one part and reject the other, and to waive technical defects, as the interests of the Service may require. Bidders are invited to be present when bids are opened. Proposals must be marked "Proposal for Pathfinder Dam, Wyoming." E. A. HITCHCOCK, Secretary.

PROPOSALS.

Macadam Road.

Freehold, N. J.

Sealed proposals will be received by the Board of Chosen Freeholders of the county of Monmouth, at the Court House, in Freehold, N. J., on Wednesday, May 10, 1905, until 11 o'clock A. M., and then publicly opened, for the construction of a macadam road between Matawan and Freehold Stone Road and the Middlesex County line on the Old Bridge Road, in the township of Matawan, in said county. Beginning in Main Street, Matawan, where the same is intersected by the road leading to Old Bridge, and running westwardly to the Middlesex County line, being 3,365 feet in length.

Each proposal must be accompanied with a certified check, made payable to the Board of Chosen Freeholders of said county, in the sum of one thousand dollars, conditioned that if the contract shall be awarded to him, he will, when required by the Board, execute an agreement in writing to faithfully perform the work according to the plans and specifications.

All proposals must be made on the blank forms furnished for that purpose. Plans can be seen, and specifications and blank forms of proposals obtained at the office of the County Collector, Freehold, N. J., of John Guire, Long Branch, or C. E. Close, Chairman, Matawan, N. J. The right to reject any or all bids is reserved.

Dated April 20, 1905.

JOHN GUIRE,
Director Board of Chosen Freeholders,
Long Branch, N. J.

Hospital Pavilions.

NOTICE TO CONTRACTORS.

Sealed proposals suitably endorsed on envelope for Construction, Heating, Plumbing and Gas Piping for two Hospital Pavilions at the Lower Quarantine Station, Swinburne Island, N. Y., may be sent by mail or delivered in person up to 12 o'clock A. M., on Monday, the 15th day of May, 1905, to Hon. Frederick Schroeder, President of the Board of Commissioners of Quarantine, at 62 William St., New York City, when the bids will be opened and read publicly.

Drawings and specifications may be consulted and blank forms of proposals obtained at the office of the Board of Commissioners of Quarantine, 62 William St., New York City, or by application to G. L. Heins, State Architect, in the Capitol at Albany, N. Y.

Contracts will be awarded to the lowest responsible and reliable bidders unless the bids exceed the amount of funds available therefor, in which case the right to reject all bids is reserved.

FREDERICK H. SCHROEDER,
President of the Board of Commissioners of Quarantine.
GEO. SCHRADER, Secretary.

Harbor Work, Valparaiso, Chile.

Works amount £2,500,000 ($12,500,000).

On the 2d of April, 1906, bids will be open in Santiago (Chile) for the construction of docks and improvement of the harbor of Valparaiso.

See plans and specifications in Washington, D. C., Chilean Legation, 1228 17th Street; in New York, Consulate General, 135 W. 11th Street.

DEPARTMENT OF THE INTERIOR, U. S. Geological Survey, Reclamation Service, Washington, D. C., Apr. 27, 1905. Sealed proposals will be received until 2 o'clock P. M., June 1, 1905, and thereafter opened, at the office of the Engineer, U. S. Reclamation Service, Glendive, Mont., for installing, in connection with the Fort Buford reclamation project, a telephone system having four telephone stations and about 70 miles of pole line, beginning opposite Glendive, Mont., on the west side of the Yellowstone River, extending northward down the Yellowstone Valley, generally following the county road and ending near the junction of the Yellowstone and Missouri Rivers at a point nearly opposite Buford, N. Dak., on the Great Northern Railroad, Specifications, forms of proposal and particulars may be obtained by applying to the Chief Engineer of the Reclamation Service, Washington, D. C., or to F. E. Weymouth, Engineer, Glendive, Mont. Each bid must be accompanied by a certified check for $1,000, payable to the order of the Secretary of the Interior, as a guaranty that the bidder will, if successful, promptly execute a satisfactory contract and furnish bond in the sum of 20 per cent. of the contract price for the faithful performance of the work. Each bid must also be accompanied by the guaranty of responsible sureties to furnish bond, as required, if the contract is awarded to the bidder. The right is reserved to reject any and all bids and to waive technical defects, if the interest of the Government requires it. Bidders are invited to be present at the opening of the proposals. Proposals must be marked "Proposals for Telephone System, Fort Buford Project, Montana and North Dakota." E. A. HITCHCOCK, Secretary.

PROPOSALS.

U. S. ENGINEER OFFICE, BOSTON, Mass., April 29, 1905. Sealed proposals for excavation, etc., at Lovells Island, Mass., will be received here until 12 M. May 29, 1905, and then publicly opened. Information on application. W. S. STANTON, Col. Engrs.

PROPOSALS FOR MISCELLANEOUS SUPplies. Office, Isthmian Canal Commission, Washington, D. C., May 1, 1905. Sealed proposals, in triplicate, will be received at the office of the Purchasing Agent, Isthmian Canal Commission, Washington, D. C., until 10.30 A. M., May 24, 1905, at which time they will be opened in public, for furnishing pipe, pipe fittings, buckets, screws, tools, piston, sheet, rubber and asbestos packing, cotton waste, soap, candles, pig lead, tin, solder, copper, zinc, bar copper, bar iron, wire, brass rod, bath brick, ground glass, metals, etc. Blanks and full information may be obtained from this office, or offices of Asst. Purchasing Agent, 24 State St., N. Y. City, or Asst. Purchasing Agent, at Custom House, New Orleans, La. H. J. GALLAGHER, Major, U. S. A., Purchasing Agent.

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Descriptions of Portland and Natural Cement Plants in the United States and Europe, with Notes on Materials and Processes in Portland Cement Manufacture.

Reprinted from THE ENGINEERING RECORD.

PUBLISHER'S NOTE.

Several years ago The Engineering Record began the publication of a series of articles upon the European Portland cement industry. The articles were prepared especially for this journal by Mr. Frederick H. Lewis, M. Am. Soc. C. E., who undertook, in the interest of this inquiry, a personal inspection of the important European plants, and who, on account of his familiarity with the subject, was well qualified to compare foreign with American practice. This series of papers had run through but a few chapters when it became evident that like descriptions of American plants, both for Portland and natural cements, would be of interest to a wide range of readers. Arrangements were accordingly made with Mr. Lewis and others for such articles and for contributions on processes and details of manufacture. The issues of The Engineering Record containing them being exhausted, the articles thus far printed are republished in this book in the belief that they afford for the first time a description of the cement industry as conducted at the present time in America and abroad.

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